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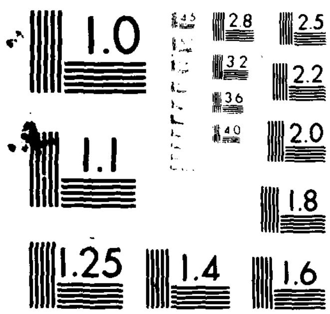

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UPPER HUDSON RIVER BASIN

TOMHANNOCK SPILLWAY DAM

NEW YORK

INVENTORY No. NY 117

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

NEW YORK DISTRICT CORPS OF ENGINEERS

AUGUST 1981

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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Rensselaer
Upper Hudson River Basin

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report provides information and analysis on the physical condition of the dam as of the report date. Information and analysis are based on visual inspection of the dam by the performing organization.

The Phase I inspection of the Tomhannock Spillway Dam did not indicate conditions which would constitute an immediate hazard to human life or property. However the dam has some deficiencies which require remedial work.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

The hydrologic/hydraulic analysis indicates that the dam will be overtopped by 1.1 feet by the Probable Maximum Flood (PMF). However, the spillway can pass the 1/2 PMF with 3.7 feet of freeboard. Therefore, the spillway is assessed as inadequate according to the Corps of Engineers' screening criteria.

The visual inspection did not reveal conditions which would indicate evidence of structural displacement or instability. The conclusion derived from evaluating the factors involved in the spillway design and forces which could act on the spillway structure is that the stability will be retained under the PMF conditions providing the composite spillway facility remains in good condition and structurally integrated.

Investigate the seepage at the toe of the earthfill embankment near the left abutment. The area should be monitored and records should be maintained to detect changing conditions which might affect the safety of the facility.

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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APPENDIX

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Tomhannock Spillway Dam I.D. NO. NY 117
State Located:	New York
County:	Rensselaer
Watershed:	Upper Hudson River Basin
Stream:	Tomhannock Creek
Date of Inspection:	May 1, 1981

ASSESSMENT OF GENERAL CONDITIONS

The Phase I inspection of the Tomhannock Spillway Dam did not indicate conditions which would constitute an immediate hazard to human life or property. However the dam has some deficiencies which require remedial work.

The hydrologic/hydraulic analysis indicates that the dam will be overtopped by 1.1 feet by the Probable Maximum Flood (PMF). However, the spillway can pass the 1/2 PMF with 3.7 feet of freeboard. Therefore, the spillway is assessed as inadequate according to the Corps of Engineers' screening criteria.

The visual inspection did not reveal conditions which would indicate evidence of structural displacement or instability. The conclusion derived from evaluating the factors involved in the spillway design and forces which could act on the spillway structure is that the stability will be retained under the PMF conditions providing the composite spillway facility remains in good condition and structurally integrated.

Investigate the seepage at the toe of the earthfill embankment near the left abutment. The area should be monitored and records should be maintained to detect changing conditions which might affect the safety of the facility.

The following deficiencies should be corrected by the Owner within one year:

1. Appropriate steps should be taken to eliminate woodchucks from the embankment.

2. The slopes of the embankment should be cleared of trees and brush and a sod cover should be established to allow easy access to the slopes for inspection.

3. The earth embankments at the abutments of the spillway should be cleared of trees and brush and material should be replaced to bring the crest to a uniform elevation throughout their entire length. Steps should be taken to secure these areas from traffic by the public.

4. The displaced riprap on the upstream face of the earthfill embankment should be repaired.

5. A formalized inspection system should be adopted and records maintained so that changing conditions at the facility may be readily detected.

6. A flood warning and emergency evacuation plan should be implemented to alert the public should conditions occur which could result in failure of the dam.

Dale Engineering Company

John B. Stetson

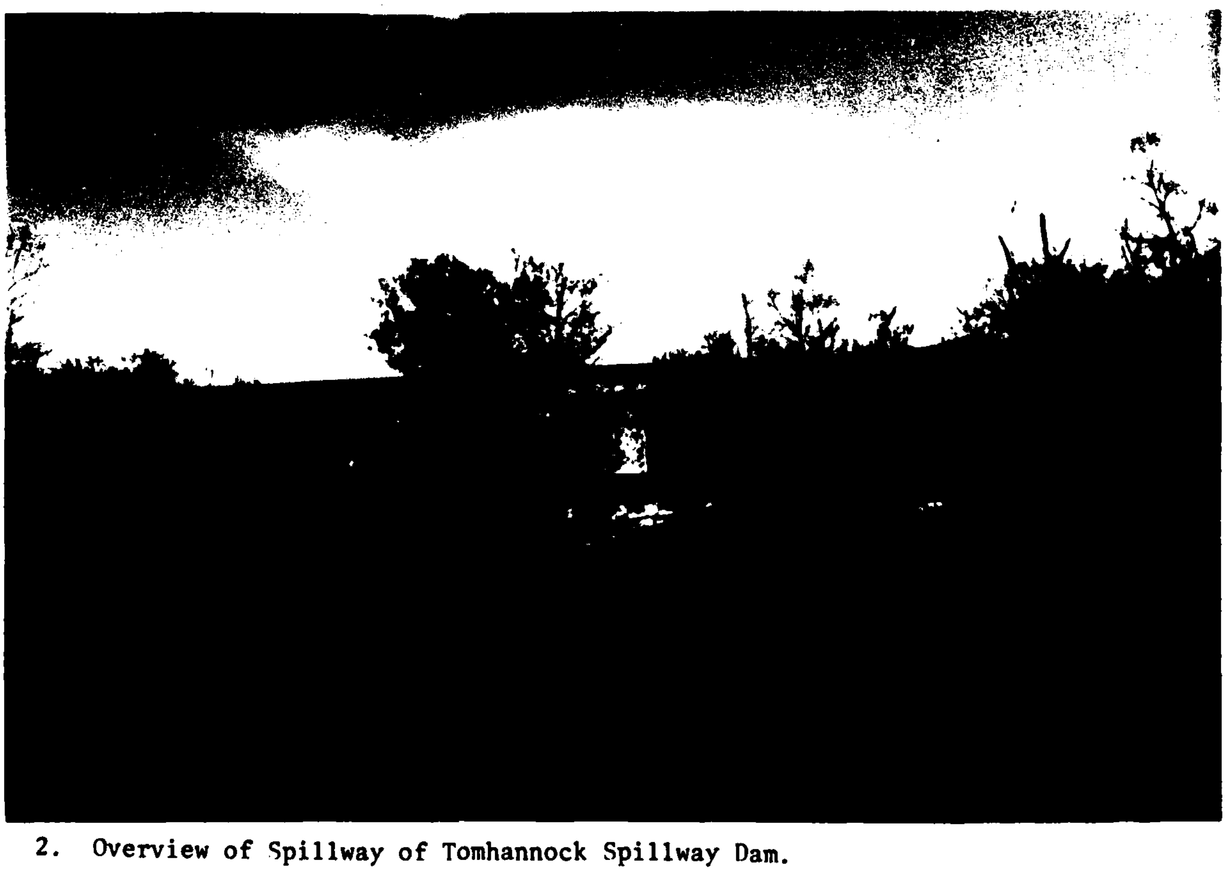
John B. Stetson, President

Richard E. Mayo, CE

Approved By: for Col. W. M. Smith, Jr.
Date: New York District Engineer

10 SEP 1981

1. Overview of embankment section of Tomhannock Spillway Dam.



2. Overview of Spillway of Tomhannock Spillway Dam.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
TOMHANNOCK SPILLWAY DAM I.D. NO. NY 117
HUDSON RIVER BASIN
RENSSELAER, NEW YORK

SECTION 1: PROJECT INFORMATION

1.1 GENERAL

a. Authority

Authority for this report is provided by the National Dam Inspection Act, Public Law 92-367 of 1972. It has been prepared in accordance with a contract for professional services between Dale Engineering Company and the U.S. Army Corps of Engineers.

b. Purpose of Inspection

The purpose of this inspection is to evaluate the existing condition of the Tomhannock Spillway Dam and appurtenant structures, owned by City of Troy, New York, and to determine if the dam constitutes a hazard to human life or property and to transmit findings to the U.S. Army Corps of Engineers.

This Phase I inspection report does not relieve an Owner or Operator of a dam of the legal duties, obligations or liabilities associated with the ownership or operation of the dam. In addition, due to the limited scope of services for these Phase I investigations, the investigators had to rely upon the data furnished to them. Therefore, this investigation is limited to visual inspection, review of data prepared by others, and simplified hydrologic, hydraulic and structural stability evaluations where appropriate. The investigators do not assume responsibility for defects or deficiencies in the dam or in the data provided.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances

The Tomhannock Spillway Dam is an earthen embankment approximately 450 feet long with a maximum height of approximately 68 feet. The Tomhannock Reservoir serves as the principal water supply source for the City of Troy, New York. The embankment has a top width of approximately 24 feet and is traversed by a rural highway. The side slopes on the embankment are 2 horizontal: 1 vertical on both slopes. The embankment contains a concrete core wall and is constructed with an impervious fill on the upstream face of the core wall. The remaining slopes of the dam are unclassified earth embankments. The upstream face of the dam is protected by riprap which extends approximately 10 feet below the normal water surface elevation. A drain line consisting of a 5-foot diameter steel pipe encased in concrete is situated near the center of the embankment. A gatehouse at the top of the embankment controls three 1' 6" x 4' 6" sluice gates at the entrance to the drain line. A second gatehouse located at

the toe of the downstream slope controls the outlet of the drain line through four 30 inch diameter gate valves which are manifolded into the drain line. The spillway from the reservoir is located approximately 1,000 feet south of the main embankment. The spillway consists of a 300 foot long, broad crested weir with an ogee shaped spillway face. This spillway is approximately 7 feet high and discharges to a concrete apron below which is located a second ogee shaped spillway with a height of approximately 11 feet into the receiving stream channel. Earth embankments approximately 200 feet long extend from the spillway abutments into original ground. The water intake for the City of Troy water system is located remote from the dam and spillway site and has no affect on dam safety.

b. Location

The reservoir is located in the Town of Pittstown and the Town of Schaghticoke, Rensselaer County, New York.

c Size Classification

The maximum height of the dam is 68 feet. The volume of the impoundment is approximately 56,600 acre feet. Therefore, the dam is in the large size classification as defined by the Recommended Guidelines for Safety Inspection of Dams.

d. Hazard Classification

Three residential properties are located near the bank of Tomhannock Creek approximately 4 miles downstream from the reservoir. Therefore, the dam is in the high hazard classification as defined by the Recommended Guidelines for Safety Inspection of Dams.

e. Ownership

The dam is owned by the City of Troy, New York.

Contact: Richard Casey
Commissioner of Public Utilities
City of Troy
65 Leversee Road
Troy, New York 12182
Telephone: (518) 270-4500

f. Purpose of the Dam

The dam is used as a water supply reservoir for the public water system of the City of Troy.

g. Design and Construction History

Plans for the Tomhannock Reservoir are dated 1902. Construction was reportedly completed on the facility in 1905. Newspaper clippings included in Appendix F indicate that failure of the principal spillway occured in the spring of 1917. Emergency repairs were made immediately after this

event. The spillway was reconstructed in approximately 1926 to the present configuration.

h. Normal Operational Procedure

Water level in the reservoir is monitored by the City of Troy, Department of Public Utilities. During normal operation, water in excess of the supply needs crests the spillway and discharges through Tomhannock Creek. Each spring, the excess flows are also allowed to discharge through the drain line. This allows for periodic exercise of the gate valves which regulate flow through the drain. The dam is periodically inspected by representatives of the City of Troy, Department of Public Utilities.

1.3 PERTINENT DATA

a. Drainage Area

The drainage area of Tomhannock Spillway Dam is 67 square miles.

b. Discharge at Dam Site

No discharge records are available for this site.

Computed discharges:

Ungated spillway, top of dam	43,560 cfs
Gated drawdown*	540 cfs

c. Elevation (feet above MSL)

Top of dam	401
Spillway crest	390
Stream bed at centerline of dam	333±

d. Reservoir

Length of normal pool	27,000 ft

e. Storage**

Top of dam	56,600 acre feet
Spillway crest	35,900 acre feet

f. Reservoir Area

Top of dam	2,000 acres
Spillway Pool	1,740 acres

* Discharge through 5 foot diameter steel blowoff pipe, with reservoir at spillway crest.

** Obtained from City of Troy - Bureau of Engineering Storage Curve, considering volume above Elevation 355 only.

g. Dam

Type - earth fill
Length - 450 feet
Height - 68 feet
Freeboard between normal reservoir and top of dam - 11 feet
Top width - 24 feet
Side slopes- Upstream: 2 horizontal: 1 vertical
Downstream: 2 horizontal: 1 vertical
Zoning - Impervious fill upstream of core wall
Impervious core - concrete core wall
Grout Curtain - none

h. Spillway

Type - concrete, inclined crest with rounded D/S corner
Length - 300 feet
Crest elevation - 390
Gates - none
U/S Channel - impoundment
D/S Channel - natural stream

i. Regulating Outlets

5 foot diameter pipe encased in concrete

Upstream: Gates, 3 - 1' 6" x 4' 6"
Downstream: Gate Valves, 4 - 30" diameter

SECTION 2 - ENGINEERING DATA

2.1 GEOTECHNICAL DATA

a. Geology

Tomhannock Reservoir is located in the Hudson Valley section of the Valley and Ridge Province. This is a part of the Appalachian Highlands, the major physiographic division. No outcrops of bedrock were seen in the vicinity of the dam or spillway. As shown on the generalized geologic map (central east part of map) south of the dam bedrock is the Middle Ordovician Canajoharie Shale. North of the dam are undifferentiated Middle Ordovocian through Lower Cambrian rocks consisting of shales, quartzite, limestone, conglomerate, and graywacke. Contact between these two is represented by a strike-slip fault which apparently passes through the dam.

The Canajoharie Shale is a soft black carbonaceous, slightly calcareous shaly claystone. Exposed, this rock weathers easily, disarticulates, and on moderte to steep slopes slumps readily.

b. Subsurface Investigations

No detailed subsurface information was available concerning the foundation of the original structure. According to the 1902 plans, the dam core wall was to be placed on hardpan and hard blue clay. The plans of 1916 show no indication as to the subsurface beneath the dam. The 1916 report states that the foundation bed under the spillway is rock and clay. A letter of 1918 states that the bed of the dam is of blue clay with a well cemented gravel below. This description suggests glacial drift. The plans included in Appendix G show some soil characteristics at test holes at the embankment and spillway.

2.2 DESIGN RECORDS

No reports were available from the original design of the dam. The available plans are included in Appendix G.

2.3 CONSTRUCTION RECORDS

No information was available concerning the original construction.

2.4 OPERATIONAL RECORDS

There are no operational records available for this dam other than the reservoir water level readings on file with the City of Troy, Department of Public Utilities.

2.5 EVALUATION OF DATA

The data presented in this report was obtained from the City of Troy, Department of Public Utilities and from the files of the New York State Department of Environmental Conservation Dam Safety Section. The available information appears to be reliable and adequate for a Phase 1 inspection report.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General

The Tomhannock Spillway Dam was inspected on May 1, 1981. The Dale Engineering Company Inspection Team was accompanied by Neil Bonesteel of the City of Troy, Department of Public Utilities. During the inspection, the weather was fair. Water level in the impoundment was 390.1.

b. Dam

The crest of the dam was of uniform section and no evidence of subsidence or misalignment was detected. The upstream slope of the earthen embankment was overgrown with trees and brush near the top of the slope. Some displacement of the riprap slope protection was detected. This displacement was probably due to vandalism. The downstream slope of the dam was overgrown with small trees and brush. The brush cover has completely shaded out the protective sod covering on the slope exposing the bare earth. Some evidence of recent cutting of brush was evident near the center of the dam. A few woodchuck burrows were detected on the downstream slope. An area of seepage approximately 40 feet along the length of the embankment and 15 feet high was detected at the toe of the slope near the left abutment. The area was soft and wet but no evidence of piping, sloughing or other displacement was detected. Wetland grasses were prevalent in the area indicating that the condition has existed for some period of time. The downstream slope of the embankment was uniform and no signs of subsidence or sloughing was detected.

c. Appurtenant Structures

Both the gatehouse at the crest of the dam and the gatehouse at the downstream toe were found to be in generally good condition. The gates in both facilities are exercised annually. Markings on the valve operating stems indicated the year in which the gates were opened during spring runoff. The inspection team also visited the water supply intake which is located remote from the dam. This facility was found to be in good condition with all mechanical equipment in operating condition. The facility, however, has no bearing upon dam safety.

d. Spillway Structure

Water was cresting the spillway to a depth of approximately 1/2 inch during the inspection. Although no close examination was possible because of the spillway discharge, the concrete on the spillway section when viewed through the flowing water showed only minor deterioration of the surface at horizontal joints. Some minor spalling has also occurred on the abutment walls of the spillway. The earth embankment sections at the abutments of the spillway section show some evidence of erosion due to pedestrian traffic. The left embankment is heavily overgrown with brush and trees so that a close inspection of this area is difficult. The crest of this embankment section does not appear to be of uniform height so that the freeboard of the facility might be slightly reduced in those areas where erosion has occurred. Erosion has also occurred at the crest of the

earth embankment immediately adjacent to the right spillway abutment. This area again would cause localized flow and erosion should the water level approach the crest of the dam. Just upstream from the spillway, a line of steel sheetpiling was evident at the surface of the ground. This sheetpiling was installed during the 1926 reconstruction of the spillway.

e. Reservoir Area

The reservoir area covers approximately 1,740 acres. The ground slopes gently at the shore of the impoundment. No known areas of slope instability are reputed to exist around the reservoir.

3.2 EVALUATION

The visual inspection revealed several deficiencies on this structure. The following items were noted:

1. The seepage at the toe of the earthfill embankment near the left abutment should be monitored and records should be maintained to detect changing conditions which might affect the safety of the facility.

2. Woodchuck holes were detected on the downstream face of the embankment. Appropriate steps should be taken to eliminate woodchucks from the embankment.

3. The slopes of the embankment should be cleared of trees and brush and sod cover should be established to allow easy access to the slopes for inspection.

4. The earth embankments at the abutments of the spillway should be cleared of trees and brush and material should be replaced to bring the crest to a uniform elevation throughout their entire length. Steps should be taken to secure these areas from traffic by the public.

5. The displaced riprap on the upstream face of the earthfill embankment should be repaired.

SECTION 4: OPERATION AND MAINTENANCE PROCEDURES

4.1 PROCEDURES

This reservoir provides the main supply of water for the City of Troy Public Water System. Water levels at the impoundment are monitored by the Department of Public Utilities. The dam is inspected periodically by personnel from the department. Excess flows are allowed to discharge through the spillway. During spring runoffs, the reservoir drain is opened to allow flow from this facility.

4.2 MAINTENANCE OF THE DAM

Maintenance and operation of the dam is controlled by the City of Troy, Department of Public Utilities. Periodic visits are made to the site to check on conditions of the facilities. Conditions at the site indicate that the facility is generally well maintained. No formalized inspection system is in effect at the facility.

4.3 MAINTENANCE OF OPERATING FACILITIES

The valves controlling flow through the reservoir are in operating condition and well maintained.

4.4 DESCRIPTION OF WARNING SYSTEM

No warning system is in effect at present.

4.5 EVALUATION

The dam and appurtenances are normally inspected by personnel from the City of Troy, Department of Public Utilities although the inspection procedure is not formalized. The following procedures should be adopted by the Owner:

1. A formalized inspection system should be adopted and records maintained so that changing conditions at the facility may be readily detected.

2. A flood warning and emergency evacuation plan should be implemented to alert the public should conditions occur which could result in failure of the dam.

SECTION 5: HYDROLOGIC/HYDRAULIC

5.1 DRAINAGE AREA CHARACTERISTICS

The vast majority of the Tomhannock Reservoir is located in Pittstown, New York, with a small portion of the reservoir and the reservoir spillway located in Schaghticoke. The dam has a drainage area of 67 square miles, which is characterized by wooded and agricultural areas interspersed by a few hamlets. The basin slopes vary from moderate to steeply sloped hillsides. A few small ponds and lakes are located in the drainage basin, but have little effect on the inflow to Tomhannock Reservoir due to their small storage capacities. The reservoir has a surface area of 2.7 square miles and discharges into Tomhannock Creek which flows in a northwesterly direction to its confluence with the Hoosic River.

5.2 ANALYSIS CRITERIA

The purpose of this investigation is to evaluate the dam and spillway with respect to their flood control potential and adequacy. This has been assessed through the evaluation of the Probable Maximum Flood (PMF) for the watershed and the subsequent routing of the flood through the reservoir and the dam's spillway system. The PMF event is that hypothetical flow induced by the most critical combination of precipitation, minimum infiltration loss and concentration of run-off of a specific location that is considered reasonably possible for a particular drainage area.

The hydrologic analysis was performed using the unit hydrograph method to develop the flood hydrograph. Due to the limited scope of this Phase I investigation, certain assumptions based on experience and existing data, were used in this analysis and in the determination of the dam's spillway capacity to pass the PMF. In the event that the dam could not pass 1/2 the Probable Maximum Flood without overtopping, additional analyses are to be performed on potential dam failures if the dam is designated as a High Hazard Classification. This process was done with the concept that if the dam was unable to satisfy this criteria, further refined hydrologic investigations would be required.

The U.S. Army Corps of Engineers' Hydrologic Engineering Center's Computer Program HEC-1 DB using the Modified Puls Method of flood routing was used to evaluate the dam, spillway capacity, and downstream hazard.

Unit hydrographs were defined by Snyder coefficients, C_t and C_p. Snyder's C_t was estimated to be 2.0 for the drainage area and C_p was estimated to be 0.625. The drainage area was divided into sub-areas to model the variability in hydrologic characteristics within the drainage basin. Run-off, routing and flood hydrograph combining was then performed to obtain the flow into the reservoir. In this analysis, the reservoir pool was assumed to be at the spillway crest elevation at the start of the storm and outflow through the low level outlet was assumed to be zero.

The Probable Maximum Precipitation (PMP) was 19.4 inches according to Hydrometeorological Report (HMR #33) for a 24-hour duration storm, 200 square mile basin, while loss rates were set at 1.0 inches initial abstraction and 0.1 inches/hour continuous loss rate. The loss rate function yielded 83 percent run-off from the PMF. The peak for the PMF inflow hydrograph was 79,084 cfs and the 1/2 PMF inflow peak was 39,282 cfs. The storage capacity of the reservoir above the spillway reduced these peak flows to 51,461 cfs for the PMF and 23,126 cfs for the 1/2 PMF flow.

5.3 SPILLWAY CAPACITY

The spillway is an uncontrolled weir 300 feet in length with an inclined crest and rounded downstream corner. The discharge capacity at the top of dam elevation is 43,560 cfs.

SPILLWAY CAPACITY

Flood	Peak Discharge	Capacity as % of Flood Discharge
PMF	51,461 cfs	85%
1/2 PMF	23,126 cfs	188%

5.4 RESERVOIR CAPACITY

The reservoir storage capacity was obtained from a curve prepared by the City of Troy, Bureau of Engineering, in 1951 for the storage capacity of the reservoir above elevation 355 and from USGS mapping. The resulting estimates of the reservoir storage capacity above elevation 355 are shown below:

Top of Dam	56,610 Acre Feet
Spillway Crest	35,900 Acre Feet

5.5 FLOODS OF RECORD

There are no available records on water levels or flood discharges for this site.

5.6 OVERTOPPING POTENTIAL

The HEC-1 DB analysis indicates that the dam will be overtopped by flows in excess of 85% of the PMF. The abutments will be overtopped by 1.1 feet by the PMF, but the 1/2 PMF can be passed by the spillway with 3.7 feet of freeboard.

5.7 EVALUATION

The hydrologic/hydraulic analysis indicates that the dam will be overtopped by 1.1 feet by the Probable Maximum Flood (PMF). However, the spillway can pass the 1/2 PMF with 3.7 feet of freeboard. Therefore, the spillway is assessed as inadequate according to the Corps of Engineers' screening criteria.

SECTION 6: STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations

The man-made structures responsible for containing the Tomhannock Reservoir at its present level include an earthen dam and a separate concrete spillway. A plan distance of approximately 1,000 feet which exists between these two structures consists of the areas natural topography, whose surface is generally slightly higher than the elevation of the earthen dam.

The 450 feet long earthen embankment and concrete core wall dam, having a maximum height on the order of 68 feet, shows no evidence of misalignment, or significant settlement or sloughing, or other conditions which would indicate serious structural movement or structural distress. However, damp-soft ground with a limited quantity of surface water exists close to the downstream toe of the dam near to the left abutment which indicate that some through-the-dam or underdam seepage occurs. Swamp type vegetation (cat-tails) has taken hold in the damp area, an implication that the seepage condition has been ongoing for some period.

The downstream face of the dam is covered with a dense growth of brush which includes some small trees; as a result, the sod/grass cover is sparse. A few small animal burrows were noted in the downstream face.

The visible zone of the upstream face of the dam is protected with a stone riprap. This protective blanket is in generally good condition but stone is missing from a few locations. A moderate growth of low and medium height vegetation exists on the upper section of this upstream slope.

Water flowing across the concrete surfaced spillway drops in two stages to the downstream channel. The 9-foot upper level drop occurs across an ogee shaped surface onto a 50-foot long apron leading to the lower level ogee shaped section, where an approximately 12-foot drop then occurs. Energy dissipating pool zones are constructed into the aprons at the base of the upper and the lower spillways. The spillway structure shows no evidence of structural distress. The exposed concrete gives the appearance of being in relatively good condition, and no structural cracking or indication of movement/displacement was noted. The concrete surface is spalling at various locations, however, the most notable being the face of the lower spillway where several inches of surface material appear to have eroded/spalled.

Earthfill sections of limited length back up the concrete abutment walls at both ends of the spillway, extending to meet the natural topography adjacent to the spillway area. No evidence of seepage through the abutments or through the earthfill sections was found. Some heavy tree growth exists on the fill section backing up the left abutment.

b. Design and Construction Data

Plans available which relate to the earthen dam indicate that a concrete core wall penetrating to "hard pan" is buttressed on the upstream side with an inner or core zone of impervious earth. The elevations to locate the site's hardpan stratum were determined from a series of test pit excavations. Unclassified earth is indicated for the upstream shell zone of the dam and the downstream half of the dam, as necessary to achieve a completed cross-section having final upstream and downstream slopes of 2 horizontal to 1 vertical. A riprap and paved surface is indicated for protecting the upstream slope, while a sod surface is indicated for the downstream slope. No stability calculations or other analysis applicable to the earthen dam have been made available.

Plans available for the spillway indicate that the concrete section for the upper level of the spillway structure is connected by a reinforced concrete apron to an embedded sheet pile and concrete cutoff wall situated some 12 feet upstream. This upper level concrete spillway section is provided with vertical and horizontal foundation keys to increase the resistance to sliding and overturning/uplift. The cross-sectional width for the sheetpile wall and upper level concrete spillway is greater than 50 feet.

The upstream sheetpile and concrete cutoff wall represents a modification to the originally constructed spillway structure. Plans indicate that initially a single line of sheetpiling was installed as a cutoff. A slab between the sheeting and the ogee spilling section did not exist. The top of the sheeting was about 4 feet lower than the crest of the concrete ogee section, and the zone between the sheeting and concrete section was filled with earth, so that only a 4-foot depth of reservior water could exist behind the concrete ogee section.

The second (newer) line of sheeting is situated 4 feet upstream of the original sheeting. A series of borings were drilled adjacent to the original line of sheet- piling, as preparation for the design/installation of that second line which was to extend to rock. The earth between sheeting lines to approximately a 20-foot depth was excavated for the installation of the reinforced concrete wall which was then structurally tied into a reinforced concrete slab/apron that extended to the crest of the concrete spillway section.

A concrete apron extends from the upper ogee spillway dissipating pool to the lower level spillway section. Plans indicate a series of underdrains are provided beneath this apron.

The lower spillway is a concrete section integrated with an older embedded sheetpiling and masonry dam/wall. Earthfill exists on the upstream and downstream sides of the now buried older wall to almost the same elevation. Earthfill against the downstream side of the wall "slopes" serve as the foundation for the concrete ogee spillway surface. The downstream

section of this part of the spillway is provided with a foundation key to provide resistance to lateral movement.

Drawings indicating the features discussed above are presented in Appendix G.

c. Operating Records

Little information relating to the operation of the facility is available. Three gates exist to control flow through the blowoff pipe extending through the earthen dam, and these gates reportedly are operated on an alternating basis once each year.

d. Post Construction Changes

No documentation exists of changes to the spillway structure following the modification brought about by the installation/construction of the upstream sheetpile-concrete cutoff wall discussed in (b) above. The July 1958 report for improvements to the spillway channel, prepared by Camp, Dresser and McKee, Consulting Engineers, Boston, Massachusetts, recommended that the then noted deteriorated spillway surface be repaired with gunite, but no information has been made available to indicate such work was accomplished.

e. Seismic Stability

A strike-slip fault is present in the valley which was dammed to create the reservoir. The north block had moved eastward, as shown on the generalized geologic map, Figure 12, Appendix G. A major thrust fault is located in the area of the dam and spillway. No earthquake activity has been recorded in the immediate vicinity of the dam.

Although the area is located within Zone 2 of the Seismic Probability Map, there is a potential for activity equivalent to a Zone 3 designation. The earthen dam and concrete spillway structures apparently bear on soil overlying rock, but the weak nature of the shale material underlying the reservoir site might influence the structural stability.

Earthquakes recorded in the area are tabulated below:

Date	Intensity Modified Mercalli	Location Relative to Dam
1877	II	17 miles WSW
1881	III	17 miles WSW
1907	IV	22 miles WSW
1916	IV-V	21 miles W
1955	V	12 miles NW
1972	III	17 miles WSW
1972	III	15 miles NW

f. Evaluation of Structural Stability

Earthen Dam: The earthen dam appears to be in good condition structurally, except for the noted seepage. The seepage condition, apparently ongoing for a number of years, has not had any adverse structural effect such as erosion or piping, and a need for correction of a structural nature is not indicated at this time. However, because minor through or underdam seepage can lead to serious problems, it is recommended that the embankment and toe areas experiencing dampness and seepage be monitored on a continuous basis. Records should be kept of these monitoring observations to obtain information which could help identify possible causes/sources of the condition and, importantly, serve as the sentinel to detect the possibility of a worsening condition and the need for remedial measures. To observe conditions properly, tall brush and trees should be removed from the slope and toe areas. Grass and low vegetation which is retained should be mowed. As a helpful measure, the areas which are experiencing dampness and seepage should be provided with a blanket of small crushed rock/gravel to retard soil erosion and provide a surface which can offer a good visual indication of the quantity and velocity of seepage flow and allow for the installation of a measuring weir.

Vegetative growth on the dam's upstream slope should be cut, and missing riprap replaced.

Spillway Structure: Design drawings available for review show the plan alignment and cross-sections for the spillway structure but do not include specific engineering information on the properties of the spillway and foundation materials, nor stability analysis. Plans and cross-sections studied for the evaluation discussed below are included in Appendix G.

Important components of the overall spillway structure are the sheetpiling concrete cutoff wall upstream of the upper level overflow section and the reinforced concrete apron connecting the cutoff wall and the spillway structure. The cutoff and apron function to prevent water seepage and resulting pressures from acting against both the upper and lower spillway sections. If the cutoff and apron are effective, the stability of the overflow sections of the spillway then become most influenced by the force of lateral earth pressures acting against upstream and downstream vertical faces (at-rest earth pressures probably act against upstream surfaces, while passive pressures can develop against downstream faces), and the friction developed along the base of the spillway section and the resistance provided by the foundation keys. Because of the relatively great concrete mass comprising the overflow sections and the relatively limited lateral earth pressure, the stability of the overflow section is great against the effects of overturning and sliding. Due to the sloping nature of the concrete apron extending between the upper overflow section and cutoff wall, the effect of ice on the structure is expected to be minimal. Similarly, the structural stability of the cutoff wall would be high; the cutoff is embedded in earth or concrete for its full depth and is subject to an active or at-rest earth pressure and hydrostatic pressure on its reservoir side, which is resisted by passive earth pressure and the lateral restraint provided by the concrete apron. Unless very weak soil materials exist against the downstream side of the cutoff wall, passive

resistance equals or exceeds pressures caused by the active/at-rest plus hydrostatic pressure conditions.

Driven interlocking steel sheetpiling cannot be assumed to retain water for an extended period without expecting some seepage through joints which could have been opened or damaged during the driving operation. For the condition of wall sheeting seepage, uplift water pressures could eventually develop against the spillway section behind the cutoff wall. Calculations of an estimated nature have been performed to obtain an indication of spillway stability if subject to uplift pressures. Utilizing the assumption that lateral earth and water pressures acting to cause instability (sliding or overturning) are counteracted by resisting lateral pressures and friction acting on the spillway and adjacent upstream and downstream aprons, the hydrostatic uplift resulting from a reservoir at the full PMF elevation is close to the condition which could create incipient instability, if the overflow structure did not develop resistance to uplift from its integration with the upstream cutoff wall and apron and the downstream apron. Instability from such a severe condition is considered unlikely because of the time factor involved for uplift pressures to increase beyond normal due to the retardation nature of soil permeability and because of the design indication of the presence of apron underdrains.

The conclusion derived from evaluating the factors involved in the spillway design and forces which could act on the spillway structure is that stability will be retained under PMF and less severe conditions, providing the composite spillway facility remains in good condition and structurally integrated. To ensure that the need for maintenance and repair as necessary to retain structural integrity is recognized, periodic inspection should be performed to examine the surface of the full spillway structure including the apron on the upstream side of the upper spillway section. A convenient time to perform the necessary examination could be in the period when the dam blowoff gates are operated and the reservoir level is lowered to the top of the sheetpiling cutoff wall.

SECTION 7: ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety

The Phase I inspection of the Tomhannock Spillway Dam did not indicate conditions which would constitute an immediate hazard to human life or property. However, the dam has some deficiencies which require remedial work.

The hydrologic/hydraulic analysis indicates that the dam will be overtopped by 1.1 feet by the Probable Maximum Flood (PMF). However, the spillway can pass the 1/2 PMF with 3.7 feet of freeboard. Therefore, the spillway is assessed as inadequate according to the Corps of Engineers' screening criteria.

The visual inspection did not reveal conditions which would indicate evidence of structural displacement or instability. The conclusion derived from evaluating the factors involved in the spillway design and forces which could act on the spillway structure is that stability will be retained under PMF and less severe conditions, providing the composite spillway facility remains in good condition and structurally integrated.

The following specific safety assessments are based on the Phase I Visual Examination and Analysis of Hydrology and Hydraulics and Structural Stability:

1. Seepage is occuring at the toe of the earthfill embankment near the left abutment. Minor seepage and sloughing also occurs beyond the toe of the embankment.

2. Woodchuck holes were detected on the downstream face of the embankment.

3. The slopes of the embankment are overgrown with trees and brush.

4. The earth embankments at the abutments of the spillway are overgrown with trees and brush and the crest of the embankments are eroded due to pedestrian traffic.

5. The riprap at the upstream face of the earthfill embankment has been displaced by vandals.

6. No formalized inspection system has been adopted.

7. No warning system is presently in effect to alert the public should conditions occur which could result in failure of the dam.

b. Adequacy of Information

The information available is adequate for a Phase I investigation.

c. Urgency

Items 1-6 of the safety assessments should be addressed by the Owner and appropriate actions taken within one year of this notification.

d. Need for Additional Investigations

Investigate the seepage at the toe of the earthfill embankment near the left abutment. This area should be monitored and records should be maintained to detect changing conditions which might affect the safety of the facility.

7.2 RECOMMENDED MEASURES

The following deficiencies should be corrected to insure safety of this facility:

1. Appropriate steps should be taken to eliminate woodchucks from the embankment.

2. The slopes of the embankment should be cleared of trees and brush and a sod cover should be established to allow easy access to the slopes for inspection.

3. The earth embankments at the abutments of the spillway should be cleared of trees and brush and material should be replaced to bring the crest to a uniform elevation throughout their entire length. Steps should be taken to secure these areas from traffic by the public.

4. The displaced riprap on the upstream face of the earthfill embankment should be repaired.

5. A formalized inspection system should be adopted to develop data on conditions and maintenance operations at the facility.

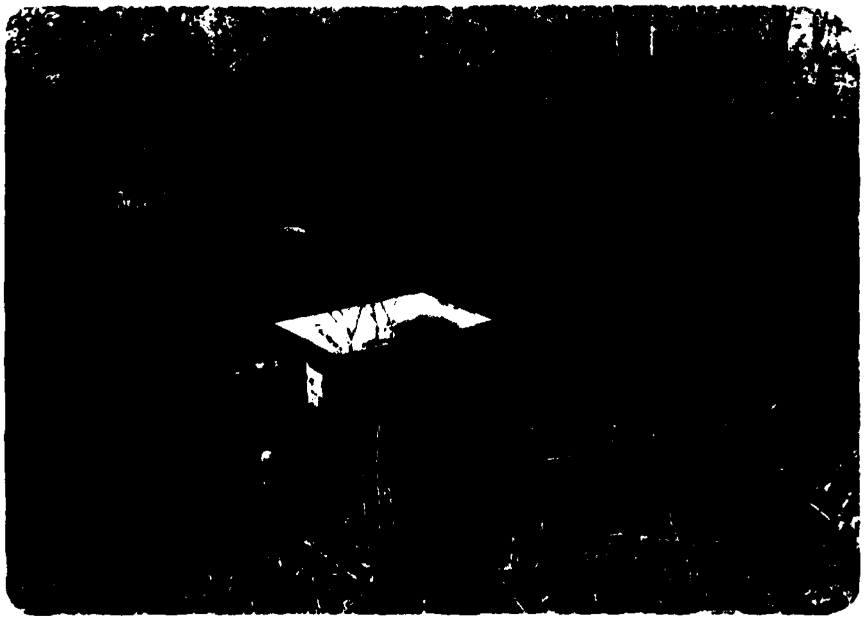
6. A flood warning and emergency evacuation plan should be implemented to alert the public should conditions occur which could result in failure of the dam.

APPENDIX A

PHOTOGRAPHS

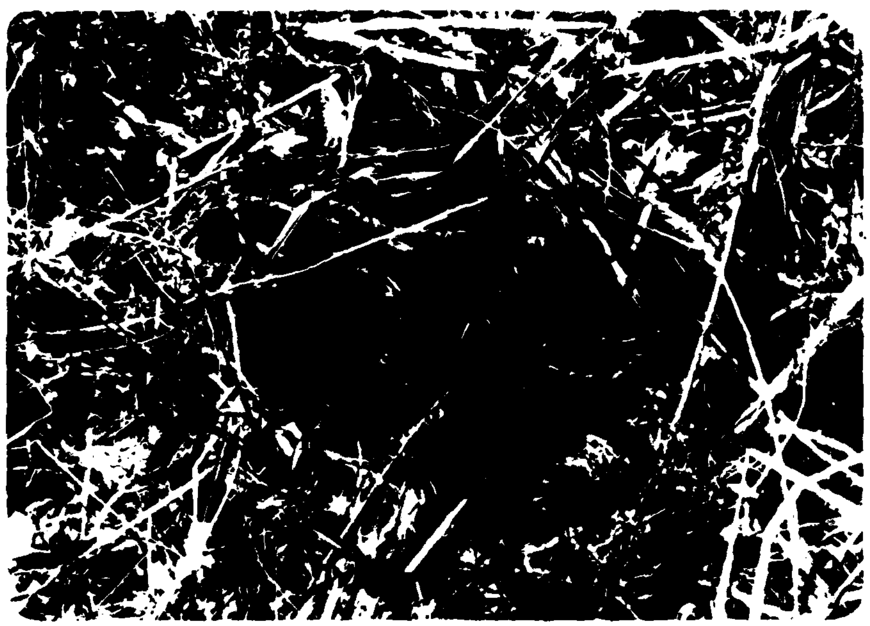
3. Upstream slope of embankment section.

4. Downstream slope of embankment section at right abutment.

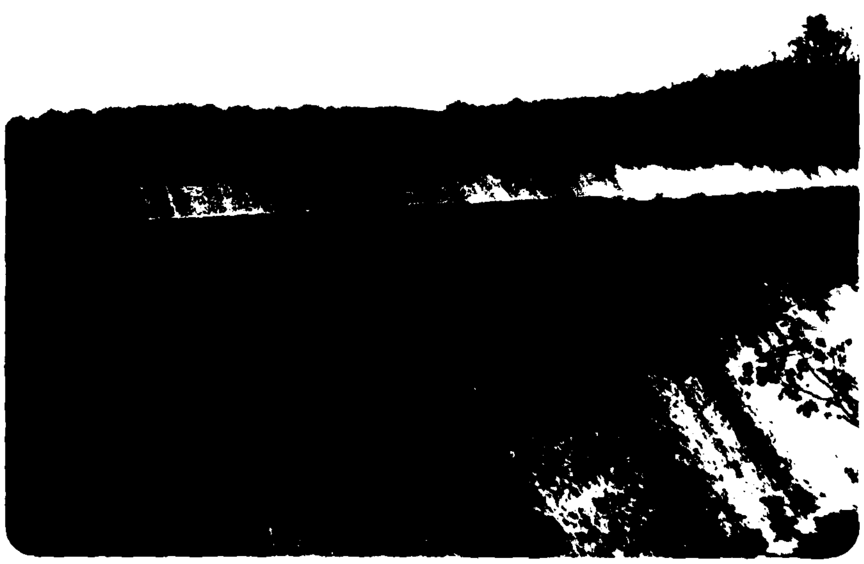


5. Gatehouse at outlet of drain line at center of downstream slope.

6. Seepage area at toe of slope near left abutment.



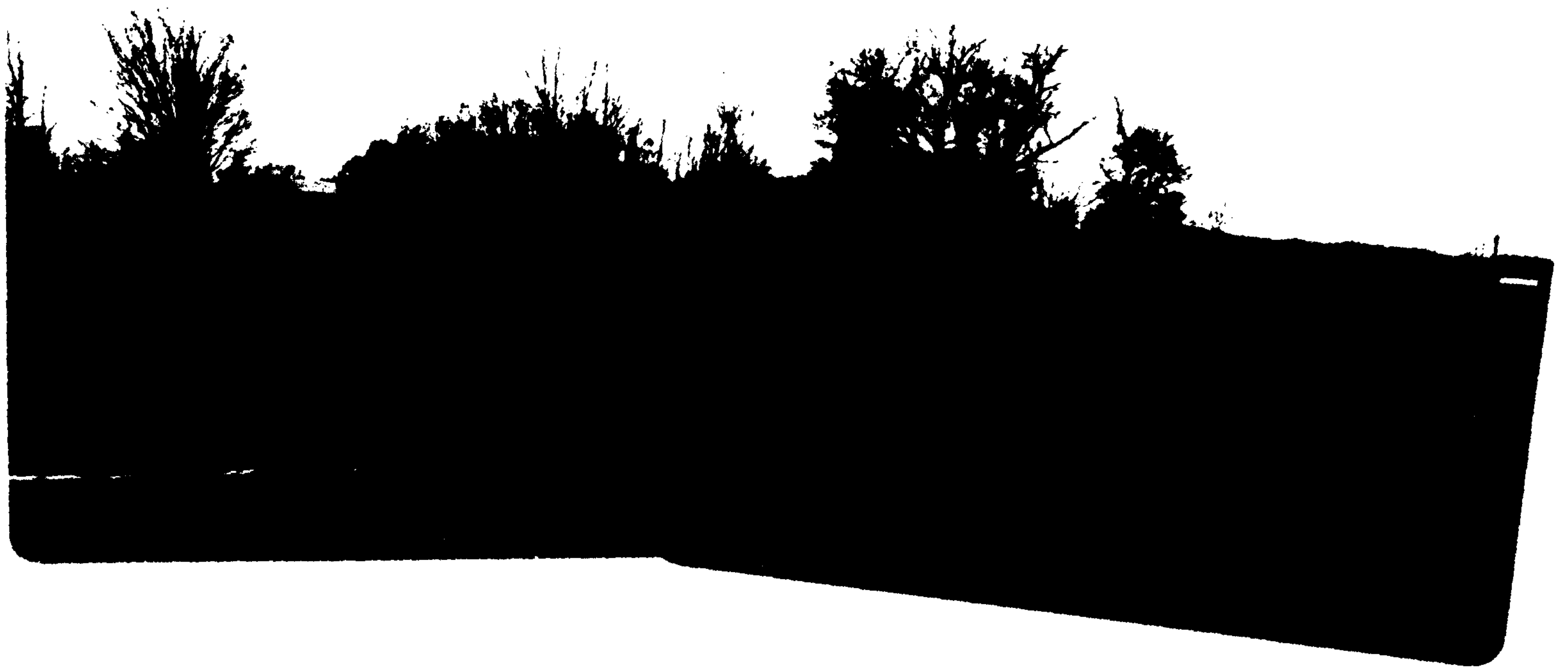
7. Closeup of seepage area.



8. Spillway from right abutment downstream.

9. Spillway from left abutment.

10. Receiving stream at spillway.



11. Residences on bank of Tomhannock Creek approximately 4 miles downstream from dam showing hazard situation.

APPENDIX B

VISUAL INSPECTION CHECKLIST

3-15-3(9/80)

VISUAL INSPECTION CHECKLIST

1) Basic Data

a. General

Name of Dam TOMHANNOCK SPILLWAY DAM

Fed. I.D. # NY 117 DEC Dam No. ______

River Basin HUDSON

Location: Town PITTSTOWN & SCHAGHTICOKE County RENSSELAER

Stream Name TOMHANNOCK

Tributary of HOOSIC RIVER

Latitude (N) 42-52.1 Longitude (W) 73-35.2

Type of Dam EARTH-FILL

Hazard Category HIGH

Date(s) of Inspection MAY 1, 1981

Weather Conditions FAIR

Reservoir Level at Time of Inspection 390.04

b. Inspection Personnel F.W. BYSZEWSKI, J.A. GOMEZ, D.F. McCARTHY, H. MUSKATT – DALE ENGINEERING CO. NEIL BONESTEEL – CITY OF TROY DEPT OF PUBLIC UTILITIES

c. Persons Contacted (Including Address & Phone No.)

RICHARD CASEY
COMMISSIONER OF PUBLIC UTILITIES
CITY OF TROY TELEPHONE: 518-270-4500
65 LEVERSEE RD
TROY N.Y. 12182

d. History:

Date Constructed 1900—1905 Date(s) Reconstructed 1926

Designer CITY OF TROY COMMISSION OF PUBLIC WORKS.

Constructed By UNKNOWN

Owner CITY OF TROY

2) Embankment

a. Characteristics

(1) Embankment Material EARTH FILL - CHARACTERISTICS UNKNOWN

(2) Cutoff Type CONCRETE CORE WALL

(3) Impervious Core IMPERVIOUS MATERIAL AT UPSTREAM FACE OF CORE WALL

(4) Internal Drainage System NONE

(5) Miscellaneous NONE

b. Crest

(1) Vertical Alignment NO IRREGULARITIES NOTED.

(2) Horizontal Alignment NO SUBSIDENCE OBSERVED

(3) Surface Cracks NONE OBSERVED - CREST IS TRAVERSED BY RURAL ROAD. BITUMINOUS SURFACE

(4) Miscellaneous NONE

c. Upstream Slope

(1) Slope (Estimate) (V:H) 1:2

(2) Undesirable Growth or Debris, Animal Burrows TREE GROWTH AT TOP OF SLOPE

(3) Sloughing, Subsidence or Depressions NONE OBSERVED

(1) Erosion at Contact NONE OBSERVED

(2) Seepage Along Contact NONE OBSERVED

3) Drainage System

a. Description of System NONE

b. Condition of System NONE

c. Discharge from Drainage System NONE

4) Instrumentation (Momumentation/Surveys, Observation Wells, Weirs, Piezometers, Etc.) NONE

5) Reservoir

a. Slopes NO EVIDENCE OF SLOPE INSTABILITY.

b. Sedimentation NO INFORMATION.

c. Unusual Conditions Which Affect Dam NONE

6) Area Downstream of Dam

a. Downstream Hazard (No. of Homes, Highways, etc.) 3 HOMES ON BANK OF CREEK APPROX 4 MI DOWNSTREAM

b. Seepage, Unusual Growth NONE

c. Evidence of Movement Beyond Toe of Dam NONE

d. Condition of Downstream Channel GOOD FREE FLOWING RECENTLY IMPROVED. 1959

7) Spillway(s) (Including Discharge Conveyance Channel)

a. General 300 FT LONG OGEE SHAPED SPILLWAY 8 ft HIGH

b. Condition of Service Spillway GOOD CONDITION - MINOR CONCRETE DETERIORATION AT HORIZONTAL JOINTS.

93-15-3(9/80)

c. ~~Condition of Auxiliary Spillway~~ NONE

EMBANKMENT AT ABUTMENT OF SPILLWAY IS ERODED

DUE TO PEDESTRIAN TRAFFIC. CREST IS OVERGROWN

WITH TREES & BRUSH AT LEFT SPILLWAY ABUTMENT.

d. Condition of Discharge Conveyance Channel GOOD CONDITION

NO RECENT EROSION NOTED.

8) Reservoir Drain/Outlet

Type: Pipe ✓ 5' DIA. Conduit ______ Other ______

Material: Concrete ______ Metal ______ Other STEEL PIPE ENCASED IN CONCRETE

395
-62
333

Size: 5' DIAMETER Length 320± ft

Invert Elevations: Entrance 333 Exit 333

Physical Condition (Describe): Unobservable ✓

Material: ~

Joints: ~ Alignment ~

Structural Integrity: ~

Hydraulic Capability: To BE COMPUTED (570 CFS PER CAMP, DRESSER & McGEE REPORT JULY 1958

Means of Control: Gate ✓ Valve ______ Uncontrolled ______

Operation: Operable ✓ Inoperable ______ Other ______

Present Condition (Describe): ALL VALVES OPERABLE AND EXERSIZED ANNUALY

INLET CONTROL 3 GATES 1'6" x 4'-6"

OUTLET CONTROL 4 GATE VALVES 30" DIA.

9) Structural

a. Concrete Surfaces NA

b. Structural Cracking NA

c. Movement - Horizontal & Vertical Alignment (Settlement) NA

d. Junctions with Abutments or Embankments NA

e. Drains - Foundation, Joint, Face NA

f. Water Passages, Conduits, Sluices NA

g. Seepage or Leakage NA

h. Joints - Construction, etc. NA

i. Foundation NA

j. Abutments NA

k. Control Gates NA

l. Approach & Outlet Channels NA

m. Energy Dissipators (Plunge Pool, etc.) NA

n. Intake Structures NA.

o. Stability NA.

p. Miscellaneous NA.

10) Appurtenant Structures (Power House, Lock, Gatehouse, Other)

a. Description and Condition WATER SUPPLY INTAKE IS REMOTE FROM DAM. ITS CONDITION HAS NO BEARING ON DAM SAFETY

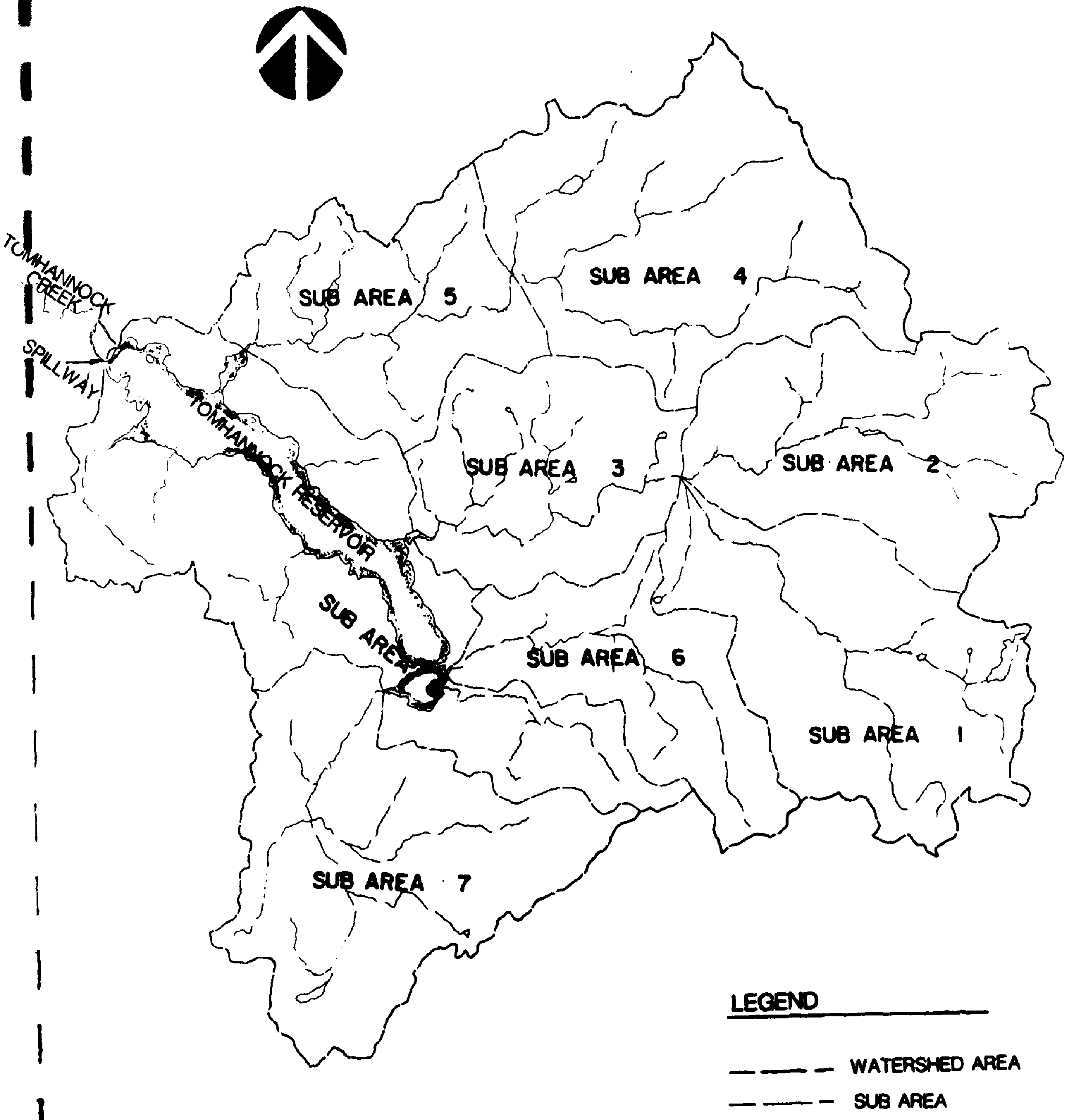
11) Operation Procedures (Lake Level Regulation):

DRAIN LINE IS OPENED DURING SPRING RUNOFF TO MINIMIZE FLOW OVER SPILLWAY. DRAIN WAS NOT OPENED DURING SPRING OF 1981 DUE TO ANTICIPATED DROUGHT CONDITIONS.

APPENDIX C

HYDROLOGIC/HYDRAULIC, ENGINEERING DATA AND COMPUTATIONS

DRAINAGE BASIN



STETSON • DALE BANKERS TRUST BUILDING UTICA • NEW YORK • 13501 TEL 315-797-5800 DESIGN BRIEF

PROJECT NAME N. Y. S. Dam Inspections DATE

SUBJECT Tomhannock Spillway Dam ID # 117 PROJECT NO. 2520

Subarea Hydrologic Parameters DRAWN BY FDM

Subarea	AREA	C_t	L	L_{CA}	$t_1 = C_t (L \times L_{CA})^{0.3}$
1	8.82 mi²	2.0	6.25 mi	3.07 mi	4.85 hr.
2	7.69	2.0	4.57	2.63	4.22
3	5.93	2.0	3.87	2.08	3.74
4	10.36	2.0	5.49	2.84	4.56
5	5.75	2.0	3.65	1.89	3.57
6	5.18	2.0	5.53	2.80	4.55
7	9.63	2.0	5.58	2.77	4.55
8	13.70	2.0	3.44	0.81	$2.72 + 0.42^* = 3.14$
	$\Sigma = 67.06$ mi²				

* Adjustment for travel time through reservoir.

$t = \frac{\text{travel distance}}{V_w}$ $V_w = \sqrt{g\ D_m}$ $g = 32.2$ ft./sec²

D_m = average depth of reservoir

$D_m = 10$ ft. $V_w = \sqrt{32.2(10)} = 17.9$ ft/sec

travel distance = 27,000 ft.

$t = \frac{27{,}000 \text{ ft.}}{17.94 \text{ fps}} = 0.42$ hr.

STETSON • DALE BANKERS TRUST BUILDING UTICA • NEW YORK • 13501 TEL 315•797•5800 **DESIGN BRIEF**

PROJECT NAME N. Y. S. Dam Inspections 1981 DATE

SUBJECT Tonhannock Spillway Dam ID # 117 PROJECT NO. 2530

Depth- Area- Duration DRAWN BY FDM

PMP From HMR # 33
for Lat. ~ 42° 52' Long. ~ 75° 18'
Index Rainfall = 19.4" for 200 mi², 24 HR
Zone 1

Duration	% Index*	Depth
6 hrs.	89.	17.3"
12 hrs.	103	20.0
24 hrs.	113	21.9
48 hrs.	120	23.3

* Adjusted for site area, Drainage Area = 6.7 mi²

STETSON • DALE BANKERS TRUST BUILDING UTICA • NEW YORK • 13501 TEL 315-797-5800 **DESIGN BRIEF**

PROJECT NAME N.Y.S. Dam Inspections 1981 DATE

SUBJECT Tomhannock Reservoir PROJECT NO. 2530

Spillway Rating Curve DRAWN BY JAG

$Q = C L H^{3/2}$

$L = 300'$

Crest Elev. = 390

"C" from "Handbook of Hydraulics" by King & Brater

Table 5-13 based on fig. 5-16

Elevation	H (ft)	C	Q (cfs)
390	0	—	0
390.5	0.5	3.32	352
391	1.0	3.44	1032
391.5	1.5	3.46	1907
392	2.0	3.42	2900
392.5	2.5	3.41	4045
393	3.0	3.46	5395
393.5	3.5	3.5	6875
394	4.0	3.55	8520
394.5	4.5	3.63	10,395
395	5.0	3.72	12,475
396	6	3.79	16,710
397	7	3.85	21,390
398	8	3.9	26,475
399	9	3.95	31,995
400	10	4.0	37,945
401	11	4.0	43,780
402	12	4.0	49,880
403	13	4.0	56,245

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PROJECT NAME N.Y.S. Dam Inspections DATE

SUBJECT Tomhannock Reservoir PROJECT NO. 2520

Spillway Rating Curve Adjusted for Submergence DRAWN BY FDM

From Tailwater Rating curve, the first elevation to be submerged is 401.

"Cs/c" from "Water Surface Profiles," Vol. 6. Publication from "The Hydrologic Engineering Center." Figure 4.03

Elevation	h_3	H_1	h_3/H_1	C_s/C	C_s	Q
401	1.7	11	0.15	0.995	3.98	43,560
402	2.6	12	0.22	0.995	3.98	43,560
403	3.0	13	0.23	0.995	3.98	43,560

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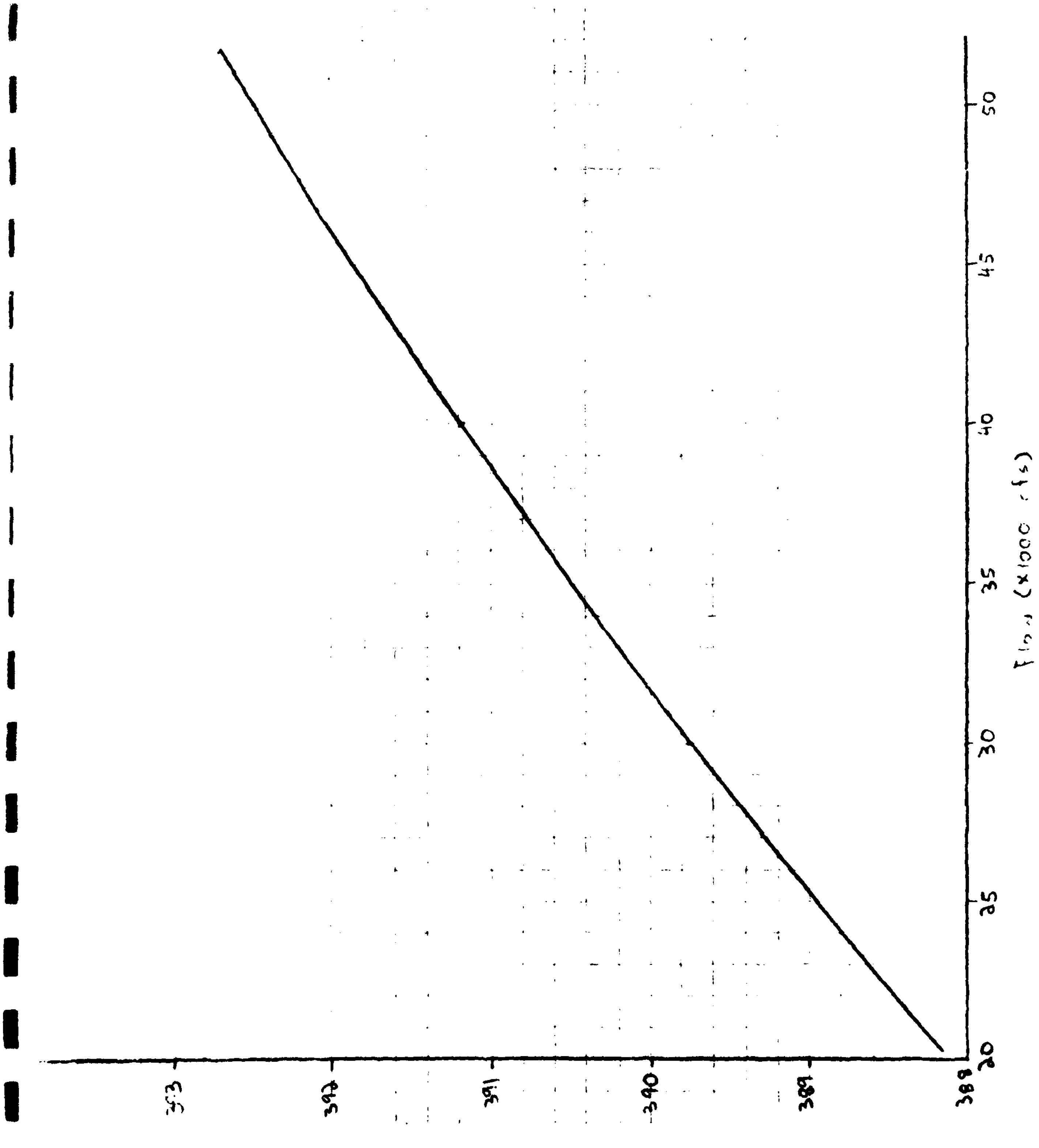
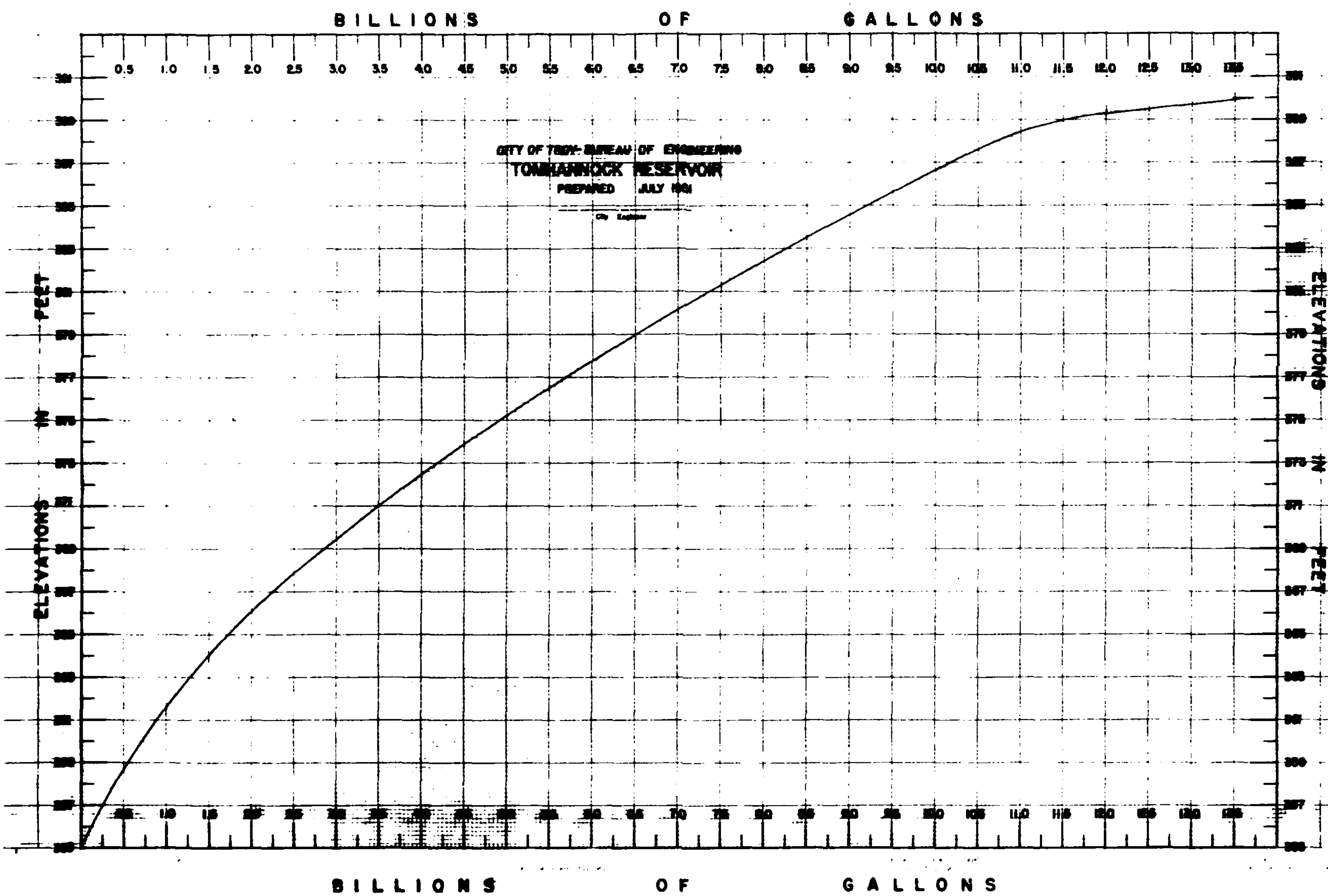
DESIGN BRIEF

PROJECT NAME: N.Y.S. Dam Inspections — DATE:

SUBJECT: Tomhannock Reservoir — PROJECT NO. 2330

Tailwater Rating Curve — DRAWN BY: FDM



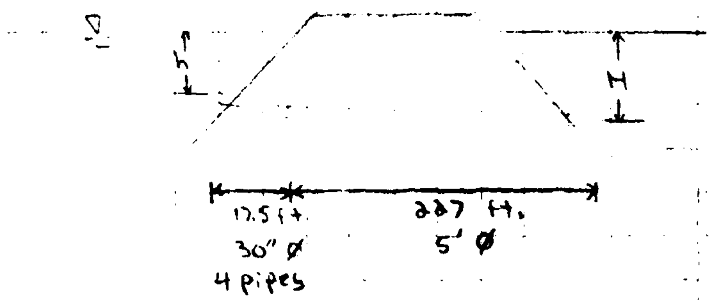

CITY OF TROY - BUREAU OF ENGINEERING
TOMHANNOCK RESERVOIR
PREPARED JULY 1961
City Engineer
BILLIONS OF GALLONS
ELEVATIONS IN FEET
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
9.0
9.5
10.0
10.5
11.0
11.5
12.0
12.5
13.0

STETSON • DALE BANKERS TRUST BUILDING UTICA • NEW YORK • 13501 TEL 315-797-5800 **DESIGN BRIEF**

PROJECT NAME N.Y.S. Dam Inspections DATE

SUBJECT Tomhannock Reservoir PROJECT NO. 3520

Reservoir Dia. Discharge Rating DRAWN BY JCM



The 4, 30" ø, pipes lead to a 5' ø culvert. Converting the system to an equivalent length of 5' pipe yields an equivalent length of 710'.

$$Q = A\sqrt{\frac{2gH}{1+K_e+K_b+K_pL}}$$

K_e = coefficient for entrance loss = 0.5
K_b = coefficient for bend loss (negligible).
K_p = coefficient for pipe friction loss.

$K_p = \frac{5100\,n^2}{D^{4/3}}$ $n = 0.013$ D = diameter in inches

$K_p = \frac{5100\,(0.013)^2}{(60)^{4/3}} = 0.00367$ $K_pL = 0.00367(710) = 2.606$

Spillway elevation: H = 48.5 ft.

$$Q = \frac{\pi}{4}(5)^2\sqrt{\frac{64.4\,(48.5)}{1+0.5+0+2.606}} = 540 \text{ cfs}$$

Top of dam elevation: H = 59.5

$$Q = \frac{\pi}{4}(5)^2\sqrt{\frac{64.4(59.5)}{4.1}} = 600 \text{ cfs}$$

CHECK LIST FOR DAMS
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

AREA-CAPACITY DATA:

	Elevation (ft.)	Surface Area (acres)	Storage Capacity (acre-ft.)
1) Top of Dam	401	2000	54,000
2) Design High Water (Max. Design Pool)	N/A	—	—
3) Auxiliary Spillway Crest	N/A	—	—
4) Pool Level with Flashboards	N/A	—	—
5) Service Spillway Crest	390	1740	32,200

DISCHARGES

	Volume (cfs)
1) Average Daily	N/A
2) Spillway @ Maximum High Water (Top of Dam)	43,560
3) Spillway @ Design High Water	N/A
4) Spillway @ Auxiliary Spillway Crest Elevation	N/A
5) Low Level Outlet w/ water level at top of dam	600
6) Total (of all facilities) @ Maximum High Water	44,160
7) Maximum Known Flood	unknown
8) At Time of Inspection	unknown

CREST: ELEVATION: 401 FT

Type: Earthfill

Width: 24 FT Length: 600 FT

Spillover Concrete gravity spillway

Location 1000' South of embankment

SPILLWAY:

PRINCIPAL		EMERGENCY
N/A	Elevation	390
	Type	Rounded Crest
	Width	300 FT
	Type of Control	
	Uncontrolled	✓
	Controlled:	
	Type (Flashboards; gate)	
	Number	
	Size/Length	
	Invert Material	Concrete
	Anticipated Length of operating service	N/A
	Chute Length	
	Height Between Spillway Crest & Approach Channel Invert (Weir Flow)	

HYDROMETEROLOGICAL GAGES:

Type : None at present

Location:

Records:

Date -

Max. Reading -

FLOOD WATER CONTROL SYSTEM:

Warning System: None at present

Method of Controlled Releases (mechanisms):

Five Ft. Diameter pipe , 3 1.5 FT X 4.5 FT sluice gates.

DRAINAGE AREA: 67 SQ. Mi.

DRAINAGE BASIN RUNOFF CHARACTERISTICS:

Land Use - Type: Mostly agricultural with a few hamlets.

Terrain - Relief: Moderate to steeply sloped

Surface - Soil: Not Known

Runoff Potential (existing or planned extensive alterations to existing (surface or subsurface conditions)

Not Known

Potential Sedimentation problem areas (natural or man-made; present or future)

Unknown

Potential Backwater problem areas for levels at maximum storage capacity including surcharge storage:

None Known

Dikes - Floodwalls (overflow & non-overflow) - Low reaches along the Reservoir perimeter:

Location: N/A

Elevation:

Reservoir:

Length @ Maximum Pool 5.2 ± (Miles)

Length of Shoreline (@ Spillway Crest) 16.5 ± (Miles)

```
(0001)  A1        TOMHANNOCK SPILLWAY DAM     FILE IS ABYT
(0002)  A2        HEC-1   (SNYDER PARAMETERS)
(0003)  A3        PMF - DAM OVERTOPPING ANALYSIS
(0004)  B     80       0      30       0       0       0       0       0       4       0
(0005)  B1     5       0       0       0       0       0       0       0       0       0
(0006)  J      1       7       1       0       0       0       0       0       0       0
(0007)  J1   0.2     0.3     0.4     0.5     0.6     0.8     1.0       0       0       0
(0008)  K      0     100       0       0       0       0       1       0       0       0
(0009)  K1        RUNOFF SUBAREA 1
(0010)  M      1       1    8.22       0   67.06       0       0       0       1       0
(0011)  P      0    19.4      89     103     113     120       0       0       0       0
(0012)  T      0       0       0       0       0       0     1.0     0.1       0   0.010
(0013)  W   4.85   0.625       0       0       0       0       0       0       0       0
(0014)  X   -2.0   -0.10     1.6       0       0       0       0       0       0       0
(0015)  K      0     200       0       0       0       0       1       0       0       0
(0016)  K1        RUNOFF SUBAREA 2
(0017)  M      1       1    7.69       0   67.06       0       0       0       1       0
(0018)  P      0    19.4      89     103     113     120       0       0       0       0
(0019)  T      0       0       0       0       0       0     1.0     0.1       0       0
(0020)  W   4.22   0.625       0       0       0       0       0       0       0       0
(0021)  X   -2.0   -0.10     1.6       0       0       0       0       0       0       0
(0022)  K      2     200       0       0       0       0       1       0       0       0
(0023)  K1        COMBINE 2 HYDROGRAPHS 1+2=3
(0024)  K      1     300       0       0       0       0       1       0       0       0
(0025)  K1        ROUTE TO SUBAREA 3
(0026)  Y      0       0       0       1       1       0       0       0       0       0
(0027)  Y1     1       0       0       0       0       0      -1       0       0       0
(0028)  Y6 0.070   0.035   0.070     430     450   23400  0.0069       0       0       0
(0029)  Y7   100     450     133     440     166     434     176     430     191     430
(0030)  Y7   201     434     233     440     366     450       0       0       0       0
(0031)  K      0     300       0       0       0       0       1       0       0       0
(0032)  K1        RUNOFF SUBAREA 3
(0033)  M      1       1    5.93       0   67.06       0       0       0       1       0
(0034)  P      0    19.4      89     103     113     120       0       0       0       0
(0035)  T      0       0       0       0       0       0     1.0     0.1       0       0
(0036)  W   3.74   0.625       0       0       0       0       0       0       0       0
(0037)  X   -2.0   -0.10     1.6       0       0       0       0       0       0       0
(0038)  K      2     300       0       0       0       0       1       0       0       0
```

(0039)	K1		COMBINE 2 HYDROGRAPHS 2+3=3								
(0040)	K	0	400	0	0	0	0	1	0	0	0
(0041)	K1		RUNOFF SUBAREA 4								
(0042)	M	1	1	10.36	0	67.06	0	0	0	1	0
(0043)	P	0	19.4	89	103	113	120	0	0	0	0
(0044)	T	0	0	0	0	0	0	1.0	0.1	0	0.005
(0045)	W	4.56	0.625	0	0	0	0	0	0	0	0
(0046)	X	-2.0	-0.10	1.6	0	0	0	0	0	0	0
(0047)	K	1	500	0	0	0	0	1	0	0	0
(0048)	K1		ROUTE TO SUBAREA 5								
(0049)	Y	0	0	0	1	1	0	0	0	0	0
(0050)	Y1	1	0	0	0	0	0	-1	0	0	0
(0051)	Y6	0.070	0.035	0.070	430	450	19200	0.0052	0	0	0
(0052)	Y7	100	450	150	440	299	434	309	430	324	430
(0053)	Y7	334	434	516	440	633	450	0	0	0	0
(0054)	K	0	500	0	0	0	0	1	0	0	0
(0055)	K1		RUNOFF SUBAREA 5								
(0056)	M	1	1	5.75	0	67.06	0	0	0	1	0
(0057)	P	0	19.4	89	103	113	120	0	0	0	0
(0058)	T	0	0	0	0	0	0	1.0	0.1	0	0.005
(0059)	W	3.57	0.625	0	0	0	0	0	0	0	0
(0060)	X	-2.0	-0.10	1.6	0	0	0	0	0	0	0
(0061)	K	2	500	0	0	0	0	1	0	0	0
(0062)	K1		COMBINE 2 HYDROGRAPHS 4+5=5								
(0063)	K	0	600	0	0	0	0	1	0	0	0
(0064)	K1		RUNOFF SUBAREA 6								
(0065)	M	1	1	5.18	0	67.06	0	0	0	1	0
(0066)	P	0	19.4	89	103	113	120	0	0	0	0
(0067)	T	0	0	0	0	0	0	1.0	0.1	0	0
(0068)	W	4.55	0.625	0	0	0	0	0	0	0	0
(0069)	X	-2.0	-0.10	1.6							
(0070)	K	0	700	0	0	0	0	1	0	0	0
(0071)	K1		RUNOFF SUBAREA 7								
(0072)	M	1	1	9.63	0	67.06	0	0	0	1	0
(0073)	P	0	19.4	89	103	113	120	0	0	0	0
(0074)	T	0	0	0	0	0	0	1.0	0.1	0	0.010
(0075)	W	4.55	0.625	0	0	0	0	0	0	0	0
(0076)	X	-2.0	-0.10	1.6	0	0	0	0	0	0	0

```
(0077)  K       0     800       0       0       0       0       1       0       0       0
(0078)  K1            RUNOFF SUBAREA 6
(0079)  M       1       1   13.70       0   67.06       0       0       0       1       0
(0080)  P       0    19.4      89     123     113     120       0       0       0       0
(0081)  T       0       0       0       0       0       0     1.0     0.1       0   0.196
(0082)  W    3.14   0.625       0       0       0       0       0       0       0       0
(0083)  X    -2.0   -0.10     1.6       0       0       0       0       0       0       0
(0084)  K       5     800       0       0       0       0       1       0       0       0
(0085)  K1            COMBINE 5 HYDROGRAPHS - TOTAL RESERVOIR INFLOW
(0086)  K       1     900       0       0       0       0       1       0       0       0
(0087)  K1            ROUTE THRU RESERVOIR AND OVER SPILLWAY
(0088)  Y       0       0       0       1       1       0       0       0       0       0
(0089)  Y1      1       0       0       0       0       0    -390      -1       0       0
(0090)  Y4  390.0   390.5   391.0   391.5   392.0   392.5   393.0   393.5   394.0   394.5
(0091)  Y4  395.0   396.0   397.0   398.0   399.0   400.0   401.0   402.0   403.0       0
(0092)  Y5      0     352    1032    1907    2900    4045    5395    6875    8520   10395
(0093)  Y5  12475   16710   21390   26475   31995   37755   43561   49631   55964       0
(0094)  $S      0    3912   10740   21480   35900   37590   39120   41120   42650   44490
(0095)  $S-46640    48460   50320   52470   54310   56610   58920   61370   63820       0
(0096)  $E    355     363     371     383     390     391     392     393     394     395
(0097)  $E    396     397     398     399     400     401     402     403     404       0
(0098)  $$    390       0       0       0       0       0       0       0       0       0
(0099)  $D    401    2.65     1.5     420       0       0       0       0       0       0
(0100)  K      99       0       0       0       0       0       0       0       0       0
(0101)  A
(0102)  A
(0103)  A
(0104)  A
(0105)  A
```

```
PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS
         RUNOFF HYDROGRAPH AT            100
         RUNOFF HYDROGRAPH AT            200
         COMBINE  2 HYDROGRAPHS AT       200
         ROUTE HYDROGRAPH TO             300
         RUNOFF HYDROGRAPH AT            300
         COMBINE  2 HYDROGRAPHS AT       300
         RUNOFF HYDROGRAPH AT            400
         ROUTE HYDROGRAPH TO             500
         RUNOFF HYDROGRAPH AT            500
         COMBINE  2 HYDROGRAPHS AT       500
         RUNOFF HYDROGRAPH AT            600
         RUNOFF HYDROGRAPH AT            700
         RUNOFF HYDROGRAPH AT            800
         COMBINE  5 HYDROGRAPHS AT       800
         ROUTE HYDROGRAPH TO             900
         END OF NETWORK
```

```
**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
**********************************

RUN  DATE?THU, JUN 18 1981
     TIME?09:41:06

                    TOMHANNOCK SPILLWAY DAM     FILE IS ABYT
                    HEC-1   (SNYDER PARAMETERS)
                    PMF - DAM OVERTOPPING ANALYSIS

                                 JOB SPECIFICATION
          NQ     NHR    NMIN    IDAY     IHR    IMIN   METRC    IPLT    IPRT   NSTAN
          80       0      30       0       0       0       0       0       4       0
                                JOPER     NWT   LROPT   TRACE
                                    5       0       0       0

                          MULTI-PLAN ANALYSES TO BE PERFORMED
                               NPLAN= 1 NRTIO= 7 LRTIO= 1
           RTIOS=   0.20    0.30    0.40    0.50    0.60    0.80    1.00


      **********        **********        **********        **********        **********

                              SUB-AREA RUNOFF COMPUTATION

             RUNOFF SUBAREA 1
                     ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                       100       0       0       0       0       0       1       0       0

                                  HYDROGRAPH DATA
          IHYDG    IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
              1       1    8.82    0.00   67.06    0.00   0.000       0       1       0

                                    PRECIP DATA
                  SPFE     PMS      R6     R12     R24     R48     R72     R96
                  0.00   19.40   89.00  103.00  113.00  120.00    0.00    0.00
TRSPC COMPUTED BY THE PROGRAM IS 0.857

                                     LOSS DATA
        LROPT   STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
            0    0.00    0.00    1.00    0.00    0.00    1.00    1.00    0.10    0.00    0.01

                                UNIT HYDROGRAPH DATA
```

```
                     TP=  4.63     CP=0.63     NTA=  0

                              RECESSION DATA
                    STRTQ=   -2.00    QRCSN=   -0.10    RTIOR= 1.60

        UNIT HYDROGRAPH 54 END-OF-PERIOD ORDINATES, LAG=   4.62 HOURS, CP= 0.62  VOL= 1.00
     24.        88.       178.       281.       393.       507.       608.       683.       730.       748.
    728.       669.       599.       537.       481.       431.       386.       345.       309.       277.
    248.       222.       199.       178.       160.       143.       128.       115.       103.        92.
     82.        74.        66.        59.        53.        48.        43.        38.        34.        31.
     27.        25.        22.        20.        18.        16.        14.        13.        11.        10.
      9.         8.         7.         7.

     0                                         END-OF-PERIOD FLOW
 MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q      MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q

                                                                        SUM  19.96  16.43   3.53  138212.
                                                                           ( 507.)( 417.)(  90.)( 3913.72)


             **********        **********        **********        **********        **********

                                       SUB-AREA RUNOFF COMPUTATION

                   RUNOFF SUBAREA 2
                          ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                            200       0       0       0       0       0       1       0       0

                                            HYDROGRAPH DATA
                 IHYDG    IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
                     1       1    7.69    0.00   67.06    0.00   0.000       0       1       0

                                             PRECIP DATA
                     SPFE     PMS      R6     R12     R24     R48     R72     R96
                     0.00   19.40   89.00  103.00  113.00  120.00    0.00    0.00
TRSPC COMPUTED BY THE PROGRAM IS 0.857

                                              LOSS DATA
               LROPT   STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
                   0    0.00    0.00    1.00    0.00    0.00    1.00    1.00    0.10    0.00    0.00

                                          UNIT HYDROGRAPH DATA
                                     TP=  4.22     CP=0.63     NTA=  0

                                              RECESSION DATA
                    STRTQ=   -2.00    QRCSN=   -0.10    RTIOR= 1.60

        UNIT HYDROGRAPH 46 END-OF-PERIOD ORDINATES, LAG=   4.18 HOURS, CP= 0.63  VOL= 1.00
     29.       107.       216.       339.       470.       592.       683.       738.       754.       718.
    642.       564.       495.       435.       382.       336.       295.       259.       227.       200.
```

```
    [illegible]    [illegible]    [illegible]    [illegible]    [illegible]    [illegible]    [illegible]    [illegible]    [illegible]    [illegible]
        48.        42.        37.        32.        28.        25.        22.        19.        17.        15.
        13.        11.        1[illegible].         9.         8.         7.

                                          END-OF-PERIOD FLOW
  MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS   COMP Q     MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q

                                                                     SUM  19.96  16.39   3.56  131115.
                                                                          ( 507.)( 416.)(  90.)( 3712.76)


      **********       **********       **********       **********       **********

                                      COMBINE HYDROGRAPHS

              COMBINE 2 HYDROGRAPHS 1+2=3
                      ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                        200       2       0       0       0       0       1       0       0


      **********       **********       **********       **********       **********

                                      HYDROGRAPH ROUTING

              ROUTE TO SUBAREA 3
                      ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                        300       1       0       0       0       0       1       0       0
                                            ROUTING DATA
              QLOSS   CLOSS     AVG    IRES   ISAME    IOPT    IPMP            LSTR
                0.0   0.000    0.00       1       1       0       0               0

                      NSTPS   NSTDL     LAG   AMSKK       X     TSK   STORA  ISPRAT
                          1       0       0   0.000   0.000   0.000     -1.       0


NORMAL DEPTH CHANNEL ROUTING
----------------------------

       QN(1)   QN(2)   QN(3)   ELNVT   ELMAX   RLNTH     SEL
      0.0700  0.0350  0.0700   430.0   450.0  20400. 0.00690

       CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
        100.00  450.00  133.00  440.00  166.00  434.00  176.00  430.00  191.00  430.00
        201.00  434.00  233.00  440.00  366.00  450.00

  STORAGE        0.00       8.69      19.98      33.86      50.39      71.58      98.39     130.82     168.87
               262.22     320.12     386.65     461.78     545.53     637.89     738.87     846.46     966.66
```

OUTFLOW	0.00	61.08	208.05	440.15	778.97	1284.63	1916.73	2695.79	3611.32
	5890.61	7288.37	8897.98	10731.41	12802.14	15123.85	17715.04	20573.95	23726.50
STAGE	430.00	431.05	432.11	433.16	434.21	435.26	436.32	437.37	438.42
	440.53	441.58	442.63	443.68	444.74	445.79	446.84	447.89	448.95
FLOW	0.00	61.08	208.05	440.15	778.97	1284.63	1916.73	2695.79	3611.32
	5890.61	7288.37	8897.98	10731.41	12802.14	15123.85	17715.04	20573.95	23726.50

MAXIMUM STAGE IS 438.5

MAXIMUM STAGE IS 440.2

MAXIMUM STAGE IS 441.6

MAXIMUM STAGE IS 442.8

MAXIMUM STAGE IS 443.8

MAXIMUM STAGE IS 445.6

MAXIMUM STAGE IS 447.1

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

RUNOFF SUBAREA 3

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
300	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	5.93	0.00	67.06	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	19.40	89.00	103.00	113.00	120.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS 0.857

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.10	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 3.74 CP=0.63 NTA= 0

RECESSION DATA

```
                 STRTQ=   -2.00    QRCSN=   -.1     RTIOR= 1.50

        UNIT HYDROGRAPH 41 END-OF-PERIOD ORDINATES, LAG=   3.76 HOURS, CP= 0.63  VOL= 1.00
      29.      108.      215.      336.      463.      562.      626.      650.      622.      551.
     476.      411.      355.      307.      265.      229.      198.      171.      147.      127.
     110.       95.       82.       71.       61.       53.       46.       39.       34.       29.
      25.       22.       19.       16.       14.       12.       11.        9.        8.        7.
       6.

   0                                         END-OF-PERIOD FLOW
MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q      MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q

                                                                       SUM  19.96  16.39   3.56  106576.
                                                                          ( 507.)( 416.)(  90.)( 3017.89)


          **********          **********          **********          **********          **********

                                          COMBINE HYDROGRAPHS

                    COMBINE 2 HYDROGRAPHS 2+3=3
                              ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                                300       2       0       0       0       0       1       0       0


          **********          **********          **********          **********          **********

                                        SUB-AREA RUNOFF COMPUTATION

                    RUNOFF SUBAREA 4
                              ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                                400       0       0       0       0       0       1       0       0

                                          HYDROGRAPH DATA
                  IHYDG    IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
                      1       1   10.36    0.00   67.06    0.00   0.000       0       1       0

                                            PRECIP DATA
                       SPFE     PMS      R6     R12     R24     R48     R72     R96
                       0.00   19.40   89.00  103.00  113.00  120.00    0.00    0.00
TRSPC COMPUTED BY THE PROGRAM IS 0.857

                                             LOSS DATA
              LROPT   STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
                  0    0.00    0.00    1.00    0.00    0.00    1.00    1.00    0.10    0.00    0.00

                                          UNIT HYDROGRAPH DATA
                                     TP=  4.56     CP=0.63    NTA=  0

                                            RECESSION DATA
```

```
                                   RECESSION DATA
                        STRTQ=   -2.00     QRCSN=   -0.10     RTIOR= 1.60

                 UNIT HYDROGRAPH 50 END-OF-PERIOD ORDINATES, LAG=   4.54 HOURS, CP= 0.63  VOL= 1.00
          33.       123.       249.       393.       547.       698.       820.       902.       943.       936.
         866.       771.       685.       607.       539.       476.       424.       377.       334.       297.
         263.       234.       207.       184.       163.       145.       126.       114.       101.        90.
          80.        71.        63.        56.        49.        44.        39.        35.        31.        27.
          24.        21.        19.        17.        15.        13.        12.        10.         9.         8.

     0                                         END-OF-PERIOD FLOW
MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q       MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q

                                                                          SUM  19.96  16.41   3.55   169962.
                                                                             ( 507.)( 417.)(  90.)( 4812.78)


        **********        **********        **********        **********        **********

                                              HYDROGRAPH ROUTING

                        ROUTE TO SUBAREA 5
                                ISTAQ   ICOMP    IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                                  500       1        0       0       0       0       1       0       0
                                                       ROUTING DATA
                        QLOSS   CLOSS     AVG     IRES   ISAME    IOPT    IPMP            LSTR
                          0.0   0.000    0.00        1       1       0       0               0

                                NSTPS   NSTDL     LAG   AMSKK       X     TSK   STORA  ISPRAT
                                    1       0       0   0.000   0.000   0.000     -1.       0


NORMAL DEPTH CHANNEL ROUTING
---------------------------

     QN(1)   QN(2)   QN(3)   ELNVT   ELMAX   RLNTH     SEL
    0.0700  0.0350  0.0700   430.0   450.0  19200. 0.00520


      CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
        100.00  450.00  150.00  440.00  299.00  434.00  309.00  430.00  324.00  430.00
        334.00  434.00  516.00  440.00  633.00  450.00

STORAGE         0.00        8.18       18.80       31.87       47.86       82.96      145.00      233.98      349.90
              660.22      838.18     1024.30     1218.58     1421.01     1631.60     1850.34     2077.24     2312.29

OUTFLOW         0.00       53.03      180.61      382.10      676.57     1155.25     1865.55     2879.18     4257.20
             8447.84    11434.15    14870.02    18748.49    23066.60    27824.05    33022.30    38664.16    44753.34

STAGE         430.00      431.05      432.11      433.16      434.21      435.26   [illegible] [illegible] [illegible]
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```
 STAGE   [illegible]  [illegible]  [illegible]  [illegible]  [illegible]  [illegible]  [illegible]  [illegible]  [illegible]
           440.53     441.56     442.63     443.68     444.74     445.79     446.84     447.89     448.95

  FLOW       0.00      53.03     160.61     382.10     676.57    1155.25    1865.55    2879.16    4257.20
          8447.84   11434.15   14870.02   18746.49   23066.60   27824.05   33022.30   38664.16   44753.34

MAXIMUM STAGE IS     436.7

MAXIMUM STAGE IS     437.7

MAXIMUM STAGE IS     438.5

MAXIMUM STAGE IS     439.2

MAXIMUM STAGE IS     439.8

MAXIMUM STAGE IS     440.8

MAXIMUM STAGE IS     441.6


        **********        **********        **********        **********        **********

                                  SUB-AREA RUNOFF COMPUTATION

                     RUNOFF SUBAREA 5
                            ISTAQ   ICOMP    IECON    ITAPE     JPLT     JPRT    INAME   ISTAGE    IAUTO
                              500       0        0        0        0        0        1        0        0

                                          HYDROGRAPH DATA
                 IHYDG     IUHG    TAREA     SNAP    TRSDA    TRSPC    RATIO    ISNOW    ISAME    LOCAL
                     1        1     5.75     0.00    67.06     0.00    0.000        0        1        0

                                            PRECIP DATA
                         SPFE      PMS       R6      R12      R24      R48      R72      R96
                         0.00    19.40    89.00   103.00   113.00   120.00     0.00     0.00
TRSPC COMPUTED BY THE PROGRAM IS 0.857

                                             LOSS DATA
              LROPT    STRKR    DLTKR    RTIOL    ERAIN    STRKS    RTIOK    STRTL    CNSTL    ALSMX    RTIMP
                  0     0.00     0.00     1.00     0.00     0.00     1.00     1.00     0.10     0.00     0.00

                                        UNIT HYDROGRAPH DATA
                                   TP=  3.57     CP=0.63     NTA=  0

                                          RECESSION DATA
                              STRTQ=   -2.00     QRCSN=   -0.10     RTIOR= 1.60

                UNIT HYDROGRAPH 39 END-OF-PERIOD ORDINATES, LAG=   3.55 HOURS, CP= 0.63   VOL= 1.00
               33.      121.      242.      377.      508.      607.      661.      664.      606.      519.
        [illegible]
```

```
   94.      80.      69.      59.      53.      43.      37.      31.      27.      23.
   23.      17.      14.      12.      11.       9.       8.       7.       6.

                                      END-OF-PERIOD FLOW
MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS   COMP Q    MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q
                                                                   SUM  19.96  16.41   3.55  105967.
                                                                       ( 507.)( 417.)(  90.)( 3000.65)

      **********        **********        **********        **********        **********

                                COMBINE HYDROGRAPHS

          COMBINE 2 HYDROGRAPHS 4+5=5
                   ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                    500       2       0       0       0       0       1       0       0

      **********        **********        **********        **********        **********

                                SUB-AREA RUNOFF COMPUTATION

          RUNOFF SUBAREA 6
                   ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                    600       0       0       0       0       0       1       0       0

                                  HYDROGRAPH DATA
          IHYDG   IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
              1      1    5.18    0.00   67.06    0.00   0.000       0       1       0

                                   PRECIP DATA
               SPFE     PMS      R6     R12     R24     R48     R72     R96
               0.00   19.40   89.00  103.00  113.00  120.00    0.00    0.00
TRSPC COMPUTED BY THE PROGRAM IS 0.857

                                   LOSS DATA
     LROPT  STRKR  DLTKR  RTIOL  ERAIN  STRKS  RTIOK  STRTL  CNSTL  ALSMX  RTIMP
         0   0.00   0.00   1.00   0.00   0.00   1.00   1.00   0.10   0.00   0.00

                              UNIT HYDROGRAPH DATA
                        TP=  4.55     CP=0.63     NTA=  0

                                  RECESSION DATA
                   STRTQ=   -2.00    QRCSN=   -0.10    RTIOR= 1.60

      UNIT HYDROGRAPH 50 END-OF-PERIOD ORDINATES, LAG=  4.53 HOURS, CP= 0.63  VOL= 1.00
     17.      62.     125.     198.     275.     351.     412.     453.     473.     469.
```

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  [illegible]    [illegible]    [illegible]    [illegible]    [illegible]    [illegible]    [illegible]    [illegible]    [illegible]    [illegible]
  131.     116.     103.      92.      81.      72.      64.      57.      5[illegible].      45.
   43.      35.      31.      28.      25.      22.      19.      17.      15.      13.
   12.      11.       9.       8.       7.       7.       6.       5.       5.       4.

      0                                END-OF-PERIOD FLOW
MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q      MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q

                                                                        SUM  19.96  16.39   3.56   84985.
                                                                           ( 507.)( 416.)(  90.)( 2406.50)


        **********        **********        **********        **********        **********

                                   SUB-AREA RUNOFF COMPUTATION

                      RUNOFF SUBAREA 7
                           ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                             700       0       0       0       0       0       1       0       0

                                         HYDROGRAPH DATA
                 IHYDG    IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
                     1       1    9.63    0.00   67.06    0.00   0.000       0       1       0

                                           PRECIP DATA
                         SPFE     PMS      R6     R12     R24     R48     R72     R96
                         0.00   19.40   89.00  103.00  113.00  120.00    0.00    0.00
TRSPC COMPUTED BY THE PROGRAM IS 0.857

                                            LOSS DATA
               LROPT   STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
                   0    0.00    0.00    1.00    0.00    0.00    1.00    1.00    0.10    0.00    0.01

                                       UNIT HYDROGRAPH DATA
                                  TP=  4.55    CP=0.63    NTA=  0

                                          RECESSION DATA
                             STRTQ=   -2.00    QRCSN=   -0.10    RTIOR= 1.60

                 UNIT HYDROGRAPH 50 END-OF-PERIOD ORDINATES, LAG=   4.53 HOURS, CP= 0.63  VOL= 1.00
        31.      115.      233.      367.      512.      652.      766.      842.      879.      871.
       807.      716.      635.      564.      500.      444.      394.      349.      310.      275.
       244.      216.      192.      170.      151.      134.      119.      105.       94.       83.
        74.       65.       58.       51.       46.       40.       36.       32.       28.       25.
        22.       20.       18.       16.       14.       12.       11.       10.        9.        8.

      0                                END-OF-PERIOD FLOW
MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q      MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q

                                                                        SUM  19.96  16.43   3.53  158360.
                                                                           [illegible]
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          **********          **********          **********          **********          **********

                                        HYDROGRAPH ROUTING

                    ROUTE THRU RESERVOIR AND OVER SPILLWAY
                          ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                            900       1       0       0       0       0       1       0       0
                                               ROUTING DATA
                    QLOSS   CLOSS     AVG    IRES   ISAME    IOPT    IPMP            LSTR
                      0.0   0.000    0.00       1       1       0       0               0

                            NSTPS   NSTDL     LAG   AMSKK       X     TSK   STORA  ISPRAT
                                1       0       0   0.000   0.000   0.000   -390.      -1

  STAGE       390.00     390.50     391.00     391.50     392.00     392.50     393.00     393.50     394.00
              395.00     396.00     397.00     398.00     399.00     400.00     401.00     402.00     403.00

   FLOW         0.00     352.00    1032.00    1907.00    2900.00    4045.00    5395.00    6875.00    8520.00
            12475.00   16710.00   21390.00   26475.00   31995.00   37755.00   43561.00   49631.00   55964.00

   CAPACITY=       0.     3912.    10740.    21480.    35900.    37590.    39120.    41120.    42650.    44490.
               46640.    48480.    50320.    52470.    54310.    56610.    58920.    61370.    63820.

   ELEVATION=    355.      363.      371.      380.      390.      391.      392.      393.      394.      395.
                 396.      397.      398.      399.      400.      401.      402.      403.      404.

                            CREL   SPWID    COQW    EXPW   ELEVL    COQL   CAREA    EXPL
                           390.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

                                                    DAM DATA
                                           TOPEL    COQD    EXPD  DAMWID
                                           401.0     2.6     1.5    420.

 PEAK OUTFLOW IS      7492. AT TIME  48.00 HOURS

 PEAK OUTFLOW IS     12630. AT TIME  47.50 HOURS

 PEAK OUTFLOW IS     17459. AT TIME  47.50 HOURS

 PEAK OUTFLOW IS     23126. AT TIME  47.00 HOURS

 PEAK OUTFLOW IS     28692. AT TIME  47.00 HOURS

 PEAK OUTFLOW IS     39945. AT TIME  47.00 HOURS

 PEAK OUTFLOW IS     51461. AT TIME  46.50 HOURS
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**********          **********          **********          **********          **********

                                  SUB-AREA RUNOFF COMPUTATION

              RUNOFF SUBAREA 8
                      ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                        800       0       0       0       0       0       1       0       0

                                      HYDROGRAPH DATA
          IHYDG    IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
              1       1   13.70    0.00   67.06    0.00   0.000       0       1       0

                                        PRECIP DATA
                    SPFE     PMS      R6     R12     R24     R48     R72     R96
                    0.00   19.40   89.00  103.00  113.00  120.00    0.00    0.00
TRSPC COMPUTED BY THE PROGRAM IS 0.857

                                         LOSS DATA
       LROPT   STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
           0    0.00    0.00    1.00    0.00    0.00    1.00    1.00    0.10    0.00    0.20

                                    UNIT HYDROGRAPH DATA
                               TP=  3.14     CP=0.63     NTA=  0

                                       RECESSION DATA
                      STRTQ=   -2.00    QRCSN=   -0.10    RTIOR= 1.60

          UNIT HYDROGRAPH 34 END-OF-PERIOD ORDINATES, LAG=   3.13 HOURS, CP= 0.63  VOL= 1.00
       103.      376.      746.     1151.     1505.     1724.     1786.     1650.     1399.     1173.
       982.      823.      690.      578.      484.      406.      340.      285.      239.      200.
       168.      140.      118.       99.       83.       69.       58.       49.       41.       34.
        29.       24.       20.       17.

       0                                 END-OF-PERIOD FLOW
  MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS   COMP Q      MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS   COMP Q

                                                                         SUM  19.96  17.09   2.86  272887.
                                                                            ( 507.)( 434.)(  73.)( 7727.29)

**********          **********          **********          **********          **********

                                    COMBINE HYDROGRAPHS

              COMBINE 5 HYDROGRAPHS - TOTAL RESERVOIR INFLOW
                      ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
```

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 0.20	RATIO 2 0.30	RATIO 3 0.40	RATIO 4 0.50	RATIO 5 0.60	RATIO 6 0.80	RATIO 7 1.00
HYDROGRAPH AT	100	8.82	1	1900.	2850.	3800.	4750.	5700.	7600.	9500.
		(22.84)	(	53.80)(	80.70)(	107.61)(	134.51)(	161.41)(	215.21)(	269.01)(
HYDROGRAPH AT	200	7.69	1	1839.	2758.	3677.	4597.	5516.	7355.	9193.
		(19.92)	(	52.07)(	78.10)(	104.13)(	130.16)(	156.19)(	208.26)(	260.32)(
2 COMBINED	200	16.51	1	3736.	5604.	7472.	9340.	11208.	14944.	18680.
		(42.76)	(	105.79)(	158.69)(	211.58)(	264.48)(	317.38)(	423.17)(	528.96)(
ROUTED TO	300	16.51	1	3679.	5520.	7357.	9198.	11040.	14728.	18423.
		(42.76)	(	104.17)(	156.30)(	208.33)(	260.44)(	312.61)(	417.04)(	521.67)(
HYDROGRAPH AT	300	5.93	1	1534.	2302.	3069.	3836.	4603.	6138.	7672.
		(15.36)	(	43.45)(	65.18)(	86.90)(	108.63)(	130.35)(	173.80)(	217.25)(
2 COMBINED	300	22.44	1	5114.	7676.	10230.	12788.	15351.	20487.	25633.
		(58.12)	(	144.81)(	217.37)(	289.67)(	362.13)(	434.69)(	580.12)(	725.86)(
HYDROGRAPH AT	400	10.36	1	2365.	3547.	4729.	5911.	7094.	9458.	11823.
		(26.83)	(	66.96)(	100.44)(	133.91)(	167.39)(	200.87)(	267.83)(	334.78)(
ROUTED TO	500	10.36	1	2229.	3349.	4475.	5606.	6762.	9090.	11432.
		(26.83)	(	63.13)(	94.82)(	126.72)(	158.75)(	191.47)(	257.39)(	323.73)(
HYDROGRAPH AT	500	5.75	1	1547.	2321.	3095.	3869.	4642.	6190.	7737.
		(14.89)	(	43.82)(	65.73)(	87.64)(	109.54)(	131.45)(	175.27)(	219.09)(
2 COMBINED	500	16.11	1	3577.	5368.	7168.	8996.	10849.	14592.	18385.
		(41.72)	(	101.30)(	152.00)(	202.99)(	254.75)(	307.21)(	413.20)(	520.60)(
HYDROGRAPH AT	600	5.18	1	1184.	1775.	2367.	2959.	3551.	4734.	5918.
		(13.42)	(	33.52)(	50.27)(	67.03)(	83.79)(	100.55)(	134.07)(	167.58)(
HYDROGRAPH AT	700	9.63	1	2202.	3302.	4403.	5504.	6605.	8807.	11008.
		(24.94)	(	62.34)(	93.52)(	124.69)(	155.86)(	187.03)(	249.38)(	311.72)(
HYDROGRAPH AT	800	13.70	1	4001.	6002.	8003.	10003.	12004.	1[illegible]005.	20006.
		([illegible])	(	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

S COMBINED	800	67.06	1	15694.	23541.	31399.	39282.	47164.	63069.	79084.	
		(173.68)		(444.40)(	666.60)(	889.11)(	1112.35)(	1335.54)(	1785.92)(	2239.40)(	
ROUTED TO	900	67.06	1	7492.	12633.	17459.	23126.	28692.	39945.	51461.	
		(173.68)		(212.16)(	357.64)(	494.38)(	654.86)(	812.45)(	1131.12)(	1457.21)(	

PLAN 1 STATION 300

RATIO	MAXIMUM FLOW, CFS	MAXIMUM STAGE, FT	TIME HOURS
0.20	3679.	438.5	44.50
0.30	5520.	440.2	44.50
0.40	7357.	441.6	44.50
0.50	9198.	442.8	44.50
0.60	11040.	443.8	44.50
0.80	14728.	445.6	44.50
1.00	18423.	447.1	44.50

PLAN 1 STATION 500

RATIO	MAXIMUM FLOW, CFS	MAXIMUM STAGE, FT	TIME HOURS
0.20	2229.	436.7	45.00
0.30	3349.	437.7	45.00
0.40	4475.	438.5	45.00
0.50	5606.	439.2	45.00
0.60	6762.	439.8	45.00
0.80	9090.	440.8	44.50
1.00	11432.	441.6	44.50

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	390.00	390.00	401.00
STORAGE	35900.	35900.	56610.
OUTFLOW	0.	0.	43561.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.20	393.69	0.00	42172.	7492.	0.00	46.00	0.00
0.30	395.04	0.00	44569.	12630.	0.00	47.50	0.00
0.40	396.16	0.00	46934.	17459.	0.00	47.50	0.00
0.50	397.34	0.00	49106.	23126.	0.00	47.00	0.00
0.60	398.40	0.00	51183.	28692.	0.00	47.00	0.00
0.80	400.38	0.00	55178.	39945.	0.00	47.00	0.00
1.00	402.09	1.09	59138.	51461.	3.50	46.50	0.00

APPENDIX D

REFERENCES

APPENDIX D

REFERENCES

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17. Y.W. Isachsen and W.G. McKendree, 1977, Preliminary Brittle Structures Map of New York, Hudson-Mohawk Sheet, New York State Museum Map and Chart Series No. 31B

18. Rudolf Ruedemann, 1930, Geology of the Capital District, New York State Museum Bulletin 285.

APPENDIX E

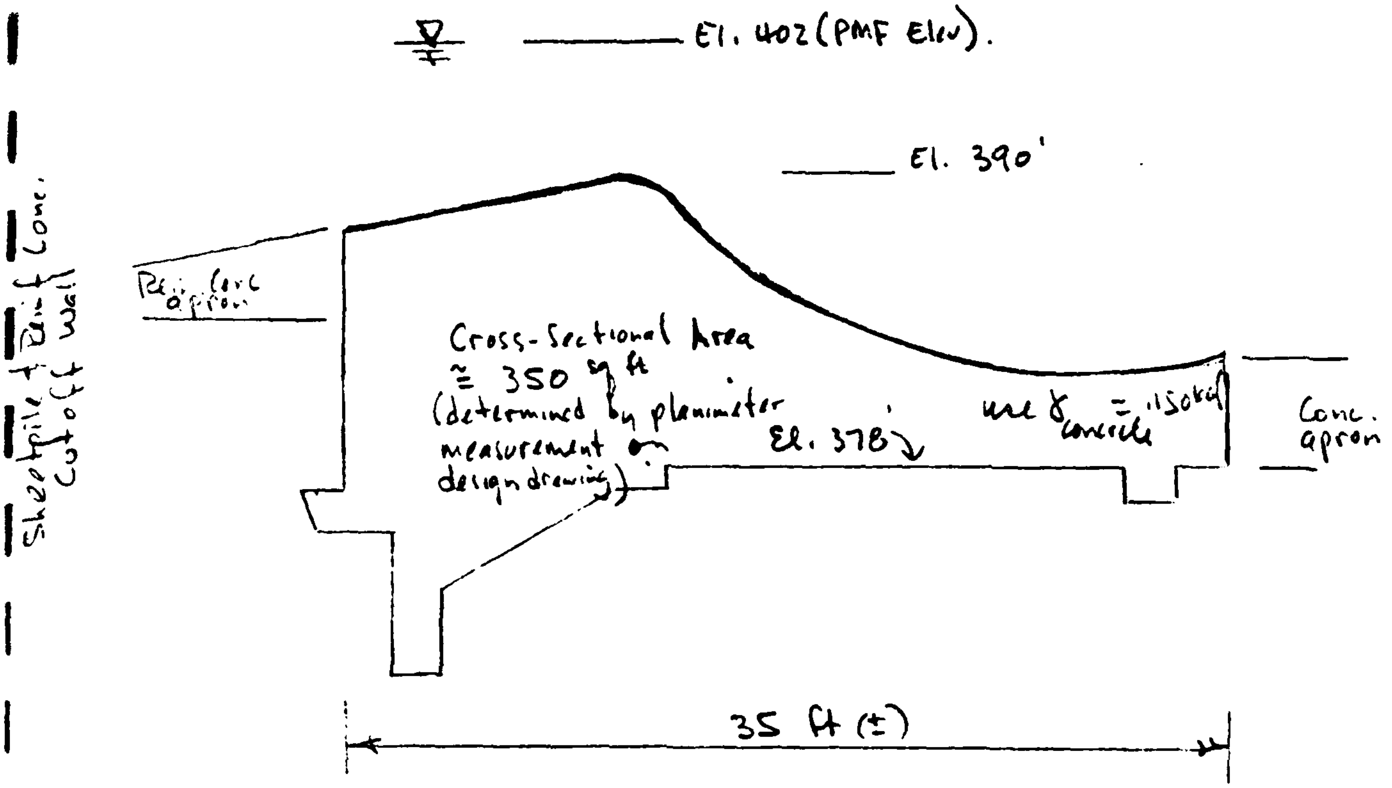
STABILITY ANALYSIS

STETSON • DALE BANKERS TRUST BUILDING UTICA • NEW YORK • 13501 TEL 315-797-5800 **DESIGN BRIEF**

PROJECT NAME Tomhannock Reservoir Spillway DATE 6/24/81

SUBJECT Stability Evaluation - Upper level spillway section PROJECT NO.

DRAWN BY DFM



Wt spillway section = $\left(350 \frac{\text{sq. ft}}{\text{ft. of length}}\right)\left(.150 \frac{k}{ft^3}\right) = 53^k \pm$

(1) Assume uplift hydrostatic pressure on base averages twelve ft. of head (390 - 378 = 12')

$P_{\text{water uplift}} = (12 \text{ ft} \times .0624 \text{ pcf})(35 \text{ ft width}) = 26^k \pm$

FS against uplift only $= \frac{53^k}{26^k} = 2 \pm$

(2) Assume uplift hydrostatic pressure on base averages 402 - 378 = 24'

$P_{\text{uplift}} = (24 \text{ ft} \times .0624 \text{ pcf} \times 35 \text{ ft}) = 52^{\pm k}$

FS against this uplift $= \frac{53^k}{52^k} = 1 \pm$

APPENDIX F

PREVIOUS INSPECTION REPORTS/AVAILABLE DOCUMENTS

2 hydroelectric plants for area

4/2[illegible]/79

By TOM McPHEETERS
Staff Writer

ALBANY — Plans to develop hydroelectric power plants at the Tomhannock Reservoir north of Troy and on the Kayaderosseras Creek near Ballston Spa were announced today by Lt. Gov. Mario Cuomo.

The Tomhannock Reservoir project could be in operation by 1983 and has the potential for [illegible] kilowatts of energy, enough to supply a "medium-sized" industrial plant, according to Parker Mathusa, project director for the New York State Energy Research and Development Authority.

Mathusa said there is no firm estimate at this time on the cost of the project, which will involve installing new generating equipment at the spillway from the Tomhannock Creek leading into the reservoir. However, he said new hydroelectric projects of this sort run from $700 to $1,000 per kilowatt, which means a project in the half million dollar range.

The reservoir is owned by the City of Troy and is located in Pittstown and Schaghticoke. Mathusa said his office has had some early discussions with Troy officials, but until a feasibility study is completed, it is not possible to say how the project will be financed or how the electrical power will be used.

NYSERDA will finance the feasibility study and probably supply some funds for development, he said.

Although NYSERDA indicated that the power generated would go into the power grid, or the general power pool for the state, Mathusa said it is just as possible that Troy would want to use the power for its own purposes.

"We're finding the economics of this is much more attractive if the local people can use it (the power generated) themselves," Mathusa said.

In fact, the Kayaderosseras Creek project is slated to be an "on-site industrial application" at the Tuffite Corp. No specific site has been selected for that project, which has an estimated capacity of 250 kilowatts.

The two projects were among [illegible] by Cuomo as he gave a keynote speech at the "Hydro [illegible]" sponsored by NYSERDA today at the Empire State Plaza. The first round of nine demonstration projects around the state has already proven that hydroelectric power is a workable alternative for the state, Cuomo said.

"The time has arrived, certainly for this state to exercise its own judgment and lead by example," Cuomo said after noting that the state now depends on foreign oil for 70 percent of its energy.

Cuomo said that NYSERDA has estimated the state's hydroelectric capacity at 3,000 megawatts, or roughly 18 percent of its current energy consumption.

#110

#225D - QUAD

PART I - INVENTORY OF DAMS IN THE UNITED STATES

(PURSUANT TO PUBLIC LAW 92-367)

See reverse side for instructions

FORM APPROVED OMB NO 49-S-73001

Reports Control Symbol DAEN-CWE-17

STATE (1)	ID NUMBER
NY	117

IDENTIFICATION

DIVISION (2)	STATE (3)	COUNTY (4)	CONGR DIST (5)	STATE (6)	COUNTY (7)	CONGR DIST (8)	NAME (9)	LATITUDE (North) (10)	LONGITUDE (West) (11)	REPORT DATE DAY MO YR (12)
11	D	11	X3	29			TOMHANNOCK SPILLWAY	4252.1	7335.2	19 JUL 80

IDENTIFICATION (Continued)

POPULAR NAME (13)	NAME OF IMPOUNDMENT (14)
	TOMHANNOCK RESERVOIR

LOCATION

REGION (15)	BASIN (16)	RIVER OR STREAM (17)	NEAREST DOWNSTREAM CITY - TOWN - VILLAGE (18)	DIST. FROM DAM (mi) (19)	POPULATION (20)
1	01	TOMHANNOCK CREEK			

STATISTICS

TYPE OF DAM (21)	YEAR COMPLETED (22)	PURPOSES (23)	STRUCTURAL HEIGHT (ft) (24)	HYDRAULIC HEIGHT (ft) (25)	IMPOUNDING CAPACITIES MAXIMUM (acre-ft.) (26)	IMPOUNDING CAPACITIES NORMAL (acre-ft.) (27)	BLANK
	1955	S	60	79		3600	

REMARKS

REMARKS (28)

- -113 ... NONE NEAR ... CONSTRUCTION

ENG FORM 4474 (ER 1110-2-1-0)

DWR DAM INSPECTION REPORT Tom HAVNUCK ·RES-

62	42	26	006110	091270	003	4
RB	CTY	YR AP.	DAM NO.	INS. DATE	USE	TYPE

AS BUILT INSPECTION

1 Location of Sp'way and outlet

1 Elevations

1 Size of Sp'way and Outlet

1 Geometry of Non-overflow section

1 GENERAL CONDITION OF NON-OVERFLOW SECTION

1 Settlement

1 Cracks

1 Deflections

1 Joints

1 Surface of Concrete

1 Leakage

1 Undermining

1 Settlement of Embankment

1 Crest of Dam

1 Downstream Slope

1 Upstream Slope

1 Toe of Slope

1 GENERAL COND. OF SP'WAY AND OUTLET WORKS

1 Auxiliary Spillway

1 Service or Concrete Sp'way

1 Stilling Basin

1 Joints

1 Surface of Concrete

1 Spillway Toe

1 Mechanical Equipment

1 Plunge Pool

1 Drain

1 Maintenance

B Hazard Class

3 Evaluation

34 Inspector

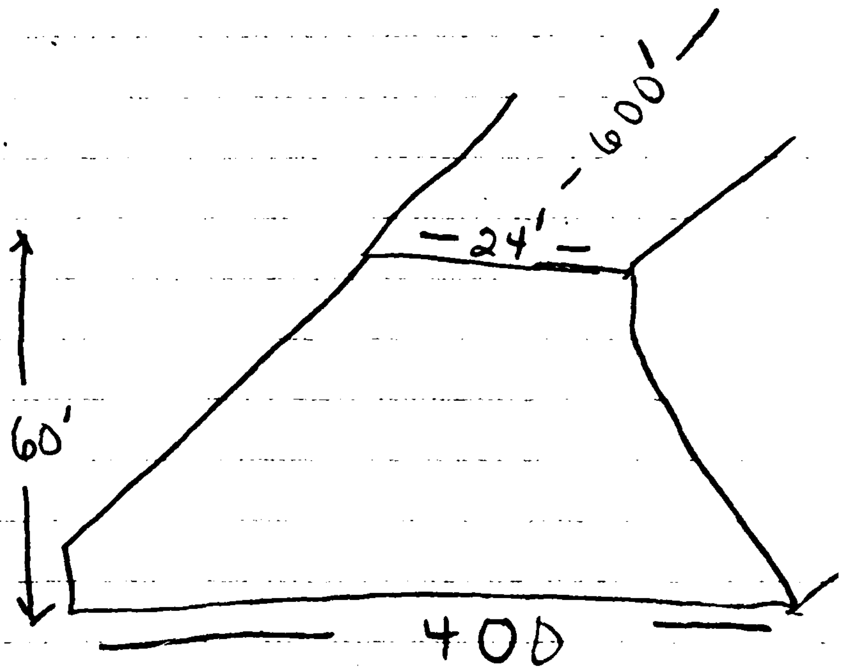
COMMENTS:

ALL IN GOOD SHAPE.

Volume Dam.

$$\frac{\frac{1}{2}(b_1+b_2)\times L\times h}{27}$$

24'



$$\frac{(24+400')\times 600\times 60}{54} = 282,666 \text{ cu yds}$$

424

Impounding cap.

$$43560\overline{)156,563,000} = 3594 \text{ acre ft.}$$

$\cancel{\tfrac{1}{2}(24+400)(60)(600) = 7,632,0}$ cu ft

PART II – INVENTORY OF DAMS IN THE UNITED STATES
(PURSUANT TO PUBLIC LAW 92-367)

See reverse side for instructions

FORM APPROVED
OMB [illegible] 49-[illegible]

Reports Control Symbol
DAEN-CWE-17

IDENTITY NO.
NY [illegible] 1 1

STATISTICS

(29) D/S HAZ	(30) CREST LENGTH (ft)	(31) TYPE	(32) SPILLWAY WIDTH (ft)	(33) SPILLWAY MAXIMUM DISCHARGE (cfs)	(34) VOLUME OF DAM (CY)	(35) POWER CAPACITY INSTALLED (MW)	(36) POWER CAPACITY PROPOSED (MW)	(37) NO.	(38) NAVIGATION LOCKS LENGTH (ft)	(39) WIDTH (ft)	(40) LENGTH (ft)	(41) WIDTH (ft)	(42) LENGTH (ft)	(43) WIDTH (ft)	(44) LENGTH (ft)	(45) WIDTH (ft)	BLANK
2	63	1	300	23000	[illegible]2[illegible]												

MISC DATA

(46) OWNER	(47) ENGINEERING BY	(48) CONSTRUCTION BY
CITY OF TROY		

MISC DATA (Continued)

(49) REGULATORY AGENCY: DESIGN	(50) CONSTRUCTION	(51) OPERATION	(52) MAINTENANCE
DEC	DEC	DEC	DEC

MISC DATA (Continued)

(53) INSPECTION BY	(54) INSPECTION DATE (DAY MO YR)	(55) AUTHORITY FOR INSPECTION
DEC	09DEC70	EN CON LAW SCT 15-[illegible]

REMARKS

(56) REMARKS
1-42-110

ENG FORM 474A (ER 1110-2-104)

March 31, 1959

Re: Reconstruction of
Spillway Channel
Dam #110
Towns of Pittstown
& Schaghticoke
County of Rensselaer

Mr. Roland E. Heacox
Chief Water Plant Operator
Melrose Laboratory
Melrose, New York

Dear Sir:

The report, plans and specifications filed by you under the provisions of Section 948 of the Conservation Law for the owner City of Troy, Bureau of Water, Troy, New York for the reconstruction of the spillway channel of Dam #110 in the Towns of Pittstown and Schaghticoke, County of Rensselaer, are approved to the extent of the authority vested in the Superintendent of Public Works under the above mentioned statute.

One set of plans and specifications, formally stamped approved, is being returned herewith.

Very truly yours,

E. W. Dayton
Deputy Chief Engineer

By: ____________________
D. C. Ogsbury
Assoc. Civil Engineer

JEP:fs
Encl.

CITY OF TROY

Melrose Laboratory

BUREAU OF WATER

MELROSE, NEW YORK

D E. HEACOX P.E.
F W R PLANT OPERATOR
ICK M EANNELLO
MIST

March 26, 1959

RECEIVED
MAR 27 1959
FLOOD CONTROL

Mr. E. W. Dayton
Deputy Chief Engineer
Division of Construction
Department of Public Works
State of New York
Albany 1, New York

Dear Sir:

Attention: Mr. D. C. Ogsbury
Associate Civil Engineer
Ref: Reconstruction of Spillway
Channel, Dam #110

We are sending you, under separate cover, two copies of those sections of the plans and specifications for Contract #1 which are applicable to the work at the Tomhannock Spillway Channel.

Bids were received on this work on March 20th last and we expect to make an early award of the contract.

I hope we will receive your approval of this work without delay.

Very truly yours,

Roland E. Heacox

ROLAND E. HEACOX, P.E.
Chief Water Plant Operator

REH/lh

RECEIVED
DEP. CH. ENG.
MAR 27 1959
FLOOD CONTROL

TROY NEW YORK HOME OF "Uncle Sam"

March 13, 1959

RE: Reconstruction of
Spillway Channel
Dam #110
Towns - Pittstown &
Schaghticoke
County- Rensselaer

Mr. Roland E. Heacox
Chief Water Plant Operator
Troy Water Bureau
Troy, New York

Dear Sir:

Receipt of an application and report prepared by the firm of Camp, Dresser and McKee, Consulting Engineers, and the return of data previously loaned to you, all pertaining to the above named dam, is hereby acknowledged.

We have reviewed and studied the report and preliminary plans and find the proposed reconstruction of spillway channel to be satisfactory to us.

However, before we grant formal approval of the proposed project it will be necessary for you to submit to us two (2) sets of the final plans and specifications.

Very truly yours,

E. W. Dayton
Deputy Chief Engineer

BY: ____________________
D. C. Ogsbury
Associate Civil Engineer

JP/em

Form E-41. (5D-TM) 2M 4-55
Ord. 7-05-7

STATE OF NEW YORK

DEPARTMENT OF PUBLIC WORKS

ALBANY

Received *March 6 1959* Dam No. 110-A

Disposition *Approved March 31, 1959* Watershed Upper Hudson

Foundation inspected ....

Structure inspected ....

Application for the Construction or Reconstruction of a Dam

Application is hereby made to the Superintendent of Public Works, Albany, N. Y., in compliance with the provisions of Section 948 of the Conservation Law (see third page of this application) for the approval of ~~specifi-~~ report and ~~cations the attached~~ drawings, marked Troy, New York Report on Improvements to Water Supply July, 1958

herewith submitted for the { ~~construction~~ reconstruction } of a ~~dam~~ spillway channel herein described. All provisions of law will be complied with in the ~~erection of the proposed dam~~ reconstruction. It is intended to complete the work covered by the application about December 1959 (Construction of Dam completed in 1904)
(Date)

1. The dam ~~will be~~ is on Tomhannock Creek flowing into Hoosic River in the towns of Pittstown & Schaghticoke County of Rensselaer and 3 miles Northeast of Melrose, N.Y. on Melrose-Valley Falls Road.
(Give exact distance and direction from a well-known bridge, dam, village, main cross-roads or mouth of a stream)

2. Location of dam is shown on the Tomhannock SE/4 Cohoes 15' quadrangle of the United States Geological Survey.

3. The name of the owner is City of Troy, N.Y. Bureau of Water

4. The address of the owner is City Hall State St. Troy, N.Y.

5. The dam ~~will be~~ is used for Water Supply

6. ~~Will~~ Is any part of the dam ~~be~~ built upon or its pond flood any State lands? No

7. The watershed above the proposed dam is 67 square miles.

8. The proposed dam will create a pond area at the spillcrest elevation of 2970 acres and will impound 156,563,000 cubic feet of water.

9. The maximum height of the proposed dam above the bed of the stream is 60 ± feet -- inches.

10. The lowest part of the natural shore of the pond is 10 feet vertically above the spillcrest, and everywhere else the shore will be at least 20 feet above the spillcrest.

11. State if any damage to life or to any buildings, roads or other property could be caused by any possible failure of the proposed dam

12. The natural material of the bed on which the proposed dam will rest is (clay, sand, gravel, boulders, granite, shale, slate, limestone, etc.)

13. Facing downstream, what is the nature of material composing the right bank?

14. Facing downstream, what is the nature of the material composing the left bank?

15. State the character of the bed and the banks in respect to the hardness, perviousness, water bearing, effect of exposure to air and to water, uniformity, etc

16. Are there any porous seams or fissures beneath the foundation of the proposed dam?

17. WASTES. The spillway of the above ~~proposed~~ dam is ~~will be~~ 300 feet long in the clear; the waters is ~~will be~~ held at the right end by earth embankment the top of which is ~~will be~~ 11 ± feet above the spillcrest, and have a top width of 10 + feet; and at the left end by same the top of which will be 11 ± feet above the spillcrest, and have a top width of 10 + feet.

18. The spillway is designed to safely discharge 23,000 cubic feet per second.

19. Pipes, sluice gates, etc., for flood discharge are ~~will be~~ provided through the dam as follows:

5 ft. Steel pipe encased in concrete.

3 sluice gates 1.5 ft x 4.5 ft.

4 30 inch gate valves

20. What is the maximum height of flash boards which will be used on this dam? None

21. APRON. Below the proposed dam there will be an apron built of None feet long across the stream, feet wide and feet thick.

22. Does this dam constitute any part of a public water supply? Yes

INSTRUCTIONS

Read carefully on the third page of this application the law setting forth the requirements to be complied with in order to construct or reconstruct a dam.

Each application for the construction or reconstruction of a dam must be made on this standard form, copies of which will be furnished upon request to the State Department of Public Works, Albany, N. Y. The application must be accompanied by three sets of plans, and specifications. The information furnished must be in sufficient detail in order that the stability and safety of the dam can be determined. In cases of large and important dams assumptions made in calculating stresses and stability should be given.

Samples of materials to be used in the dam and of the material on which the dam is to be founded may be asked for, but need not be furnished unless requested.

If the dam constitutes a part of a public water supply, application should be made to the Water Power and Control Commission under Article XI of the Conservation Law.

An application for the construction or reconseruction of a dam must be signed by the prospective owner of the dam or his duly authorized agent. The address of the signer and the date must be given as provided for on the last page of the application form.

SECTION 948 OF THE CONSERVATION LAW

§ 948. Structures for impounding water; inspection of docks; penalties. No structure for impounding water and no dock, pier, wharf or other structure used as a landing place on waters shall be erected or reconstructed by any public authority or by any private person or corporation without notice to the superintendent of public works, nor shall any such structure be erected, reconstructed or maintained without complying with such conditions as the superintendent of public works may by order prescribe for safeguarding life or property against danger therefrom. No order made by the superintendent of public works shall be deemed to authorize any invasion of any property rights, public or private, by any person in carrying out the requirements of such order. The superintendent of public works shall have power, whenever in his judgment public safety shall so require, to make and serve an order, setting forth therein his findings of fact and his conclusions therefrom, directing any person, corporation, officer or board, constructing, maintaining or using any structure hereinbefore referred to, either remove the said structure or to repair or reconstruct the same within such reasonable time and in such manner as shall be specified in such order, and it shall be the duty of every such person, corporation, officer or board, to obey, observe and comply with such order and with the conditions prescribed by the superintendent of public works for safeguarding life or property against danger therefrom, and every person, corporation, officer or board failing, omitting or neglecting so to do, or who hereafter erects or reconstructs any such structure hereinbefore referred to without submitting to the superintendent of public works and obtaining his approval of plans and specifications for such structures when required to do so by his order or hereafter fails to remove, erect or to reconstruct the same in accordance with the plans and specifications so approved shall forfeit to the people of the State a sum not to exceed five hundred dollars to be fixed by the court for each and every offense; every violation of any such order shall be a separate and distinct offense, and, in such case of a continuing violation, every day's continuance thereof shall be and be deemed to be a separate and distinct offense. Such order shall not contain any provision to compel the owner to make repairs or proceed with reconstruction as specified in this section by any type of construction other than that of the dam itself. In addition to said forfeiture upon the violation of any such order, the superintendent of public works shall have power to enter upon the lands and waters where such structures are located, for the purpose of removing, repairing or reconstructing the same, and to take such other and further precautions which he may deem necessary to safeguard life or property against danger therefrom. In removing, repairing and reconstructing such dam the superintendent shall not deviate from the method, manner or specifications contained in the original order. The superintendent of public works shall certify the amount of the costs and expenses incurred by him for the removal, repair or reconstruction aforesaid, or in anywise connected therewith, to the board of supervisors of the county or counties in which the said lands and waters are located, whereupon it shall be the duty of such board of supervisors to add the amount so certified to the assessment rolls of such locality or localities as a charge against the real property upon which the dam is located designated or described by the superintendent of public works as chargeable therewith, and to issue its warrant or warrants for the collection thereof. Thereupon it shall become the duty of such locality or localities through their proper officers to collect the amounts so certified in the same manner as other taxes are collected in such locality or localities, and when collected, to pay the same to the superintendent of public works

who shall thereupon pay the same into the treasury. Any amount so levied shall thereupon become a lien upon the real property affected thereby, to the same extent as any tax levy becomes and is a lien thereon.

Any person in interest may, within thirty days from the service of any such order, appeal to the supreme court to determine the reasonableness of such order. At any time during such appeal to the supreme court upon at least three days' notice, the party appealing may apply for an order directing any question of fact to be tried and determined by a jury, and the court shall thereupon cause such question to be stated for trial accordingly and the findings of the jury upon such question shall be conclusive. Appeals may be taken from the supreme court to the appellate division of the supreme court and to the court of appeals in such cases, subject to the limitations provided in the civil practice act.

This section shall not apply to a dam where the area draining into the pond formed thereby does not exceed one square mile, unless the dam is more than ten feet in height above the natural bed of the stream at any point or unless the quantity of water which the dam impounds exceeds one million gallons; nor to a dock, pier, wharf or other structure under the jurisdiction of the department of docks, if any, in a city of over one hundred and seventy-five thousand population. This section as hereby amended shall not impair the effect of an order heretofore made by the conservation commission or commissioner under this section prior to the taking effect of chapter four hundred and ninety-nine of the laws of nineteen hundred and twenty-one, nor require the approval by the superintendent of public works, of plans and specifications theretofore approved by such commission or commissioner under this section.

The foregoing information is correct to the best of my knowledge and belief, and the construction will be carried out in accordance with the approved plans and specifications.

City of Troy, N.Y. Bureau of Water, Owner

By Joseph F. Hayden, authorized agent of owner.
Joseph F. Hayden Commissioner Public Works
Address of signer City Hall, State St. Troy, N.Y. Date January 23 1959

December 4, 1958

Mr. Roland E. Heacox
Chief Water Plant Operator
Troy Water Bureau
Troy, New York

Dear Sir:

This is to remind you that you have on loan from us the following items:

1. One blueprint of existing dam #110
2. Nine clippings pertaining to dam #110
3. One U.S.G.S. map
4. Four applications dated as follows:
   April 17, 1918, June 20, 1916, June 20, 1916 and August 2, 1926

If you have already made photostatic copies of the above items, may we request you to return them to this Department, attention of Mr. D. C. Ogsbury, at your earliest convenience.

Very truly yours,

Henry TenHagen
Deputy Chief Engineer

By: ____________________
D. C. Ogsbury
Assoc. Civil Engineer

JEP:fs

TROY, NEW YORK

REPORT ON IMPROVEMENTS TO WATER SUPPLY

JULY, 1958

CAMP, DRESSER & McKEE
Consulting Engineers
Boston, Massachusetts

CAMP, DRESSER & McKEE

CONSULTING ENGINEERS

THOMAS R. CAMP
HERMAN G. DRESSER
ROLAND S. BURLINGAME
JOSEPH C. LAWLER
DARRELL A. ROOT

6 BEACON STREET
BOSTON 8 MASSACHUSETTS
TELEPHONE RICHMOND 2-1710

WATER WORKS AND WATER TREATMENT
SEWERAGE AND SEWAGE TREATMENT
MUNICIPAL AND INDUSTRIAL WASTES
FLOOD CONTROL
INVESTIGATIONS AND REPORTS
DESIGN AND SUPERVISION
RESEARCH AND DEVELOPMENT

July 11, 1958

Mr. Joseph F. Hayden
Commissioner of Public Works
City of Troy
Troy, New York

Dear Mr. Hayden: Report on Improvements to Water Supply

In compliance with the terms of our letters of May 8, 1958, and May 23, 1958, addressed to Mr. Roland E. Heacox, Chief Water Plant Operator of the Troy Water Bureau, and subsequent instructions from Mr. Heacox, we have made an engineering investigation to prepare preliminary designs and cost estimates for the construction of certain water supply facilities which are needed at once either for the purpose of preventing failure of major water supply works or for the purpose of protecting the quality of the water delivered to the consumers and the reliability of the supply. The results of our studies are presented in detail in the following report and are summarized below.

Summary

The total estimated cost of works recommended for immediate construction is $433,850, including allowances for engineering and contingencies. The items covered in this report which are recommended for immediate construction are: (1) improvements to blow-off facilities at Tomhannock Dam, estimated to cost $11,200; (2) improvements at Tomhannock Intake, estimated to cost $37,600; (3) reconstruction of Tomhannock Spillway channel, estimated to cost $320,400; (4) desilting of Quacken Kill diverting reservoir, estimated to cost $33,750; (5) improvement of chlorination facilities at Quacken Kill diverting reservoir, estimated to cost $12,600; and (6) improvement of chlorinating facilities at the Vanderheyden Reservoir, estimated to cost $18,300.

The most important of the six items recommended for immediate construction is the Tomhannock spillway channel, which represents over 70% of the total estimated cost of all six items. The existing channel is in an advanced stage of destruction. If it is not replaced immediately, there is danger of loss of the highway bridge and of the Tomhannock spillway dam itself by floods of moderate size which may be expected at any time. It is strongly recommended that authorization for construction be obtained as quickly as possible so that the project can be undertaken this fall when the reservoir can be drawn down. If authorization is obtained within about a month's time, it should be possible to complete construction prior to the 1959 spring runoff.

Some improvements not considered in this report but which have been studied by Mr. Heacox are also urgently needed at this time. Moreover, a comprehensive engineering study of the entire system, such as described in our letter of April 9, 1958 to Mr. Heacox, is badly needed to develop a long-range plan for the rehabilitation and improvement of the entire system. The water is of poor quality and not adequately treated according to modern standards for the protection of the consumer and the supply and distribution works have suffered from many years of neglect.

We wish to express our appreciation to you, to Mr. Heacox, to Mr. Smith, and to other members of the staff of the Department of Public Works for the cooperation given us in our studies.

Yours very truly,

CAMP, DRESSER & McKEE

By Thomas R. Camp

Thomas R. Camp

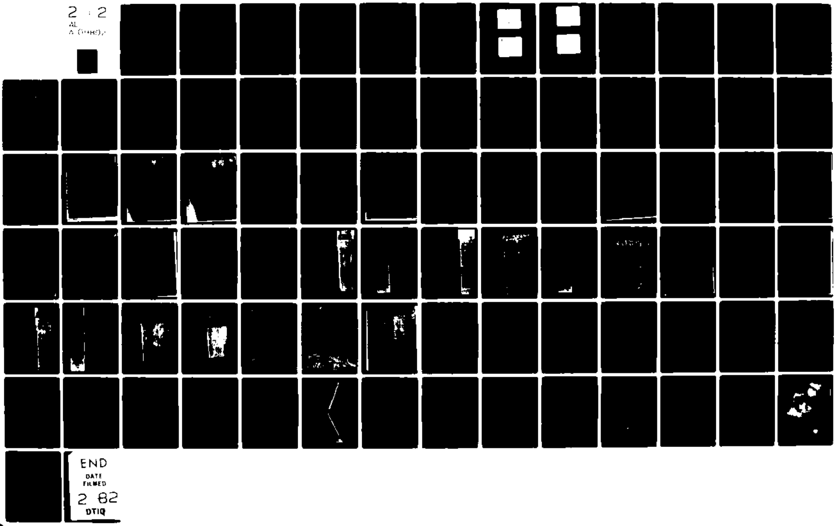
TABLE OF CONTENTS

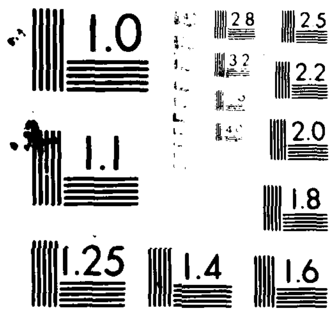
LIST OF TABLES

LIST OF FIGURES

AD-A109 802 STETSON-DALE UTICA NY F/G 13/13
NATIONAL DAM SAFETY PROGRAM. TOMHANNOCK SPILLWAY DAM (INVENTORY--ETC(U)
AUG 81 J B STETSON DACW51-81-C-0009
UNCLASSIFIED NL

2 : 2





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963 A

TROY, NEW YORK

REPORT ON IMPROVEMENTS TO WATER SUPPLY

Scope of Investigation

The purpose of the investigation described in this report was to prepare preliminary designs and cost estimates for the construction of certain water supply facilities which are needed at once, either for the purpose of preventing failure of major water supply works or for the purpose of protecting the quality of the water delivered to the consumers and the reliability of the supply. Some improvements not considered in this report, but which have been studied by Mr. Heacox, are also urgently needed at this time. Moreover, a comprehensive engineering study of the entire system, such as described in our letter of April 9, 1958, to Mr. Heacox, is badly needed to develop a long-range plan for the rehabilitation and improvement of the system.

The items covered in this report are (1) improvements to blowoff facilities at Tomhannock Dam, (2) improvements at Tomhannock intake, (3) reconstruction of Tomhannock spillway channel, (4) desilting of Quacken Kill diverting reservoir, (5) improvement of chlorination facilities at Quacken Kill diverting reservoir, and (6) improvement of chlorinating facilities at the Vanderheyden Reservoir.

The results of the studies for each of these items are presented in detail below, together with cost estimates and recommendations.

1. Blowoff Facilities at Tomhannock Dam

The dam presently contains three sluice gates with 1-ft 6-in by 4-ft 6-in clear openings at the upstream toe of the dam, under about 50 ft of water. These sluice gates discharge through a 5-ft diameter steel pipe encased in concrete laid under the dam to the downstream toe of the dam. At the downstream toe of the dam the 5-ft pipe enters a header arrangement which discharges through four 30-in gate valves into a small stilling pool.

There is no record of the sluice gates having been operated for many years prior to this investigation. Some years ago a diver who inspected the sluice gates reported that one of the gates had a broken stem, and that one or more of the gates were covered with bags of cement. It was essential that the blow-off facilities be put in working condition so that they can be used during the proposed reconstruction of the spillway channel.

With the assistance of employees of the Troy Water Bureau, water was pumped into the 5-ft pipe under the dam to develop an excess pressure on the underside of the sluice gates of about 3 psi, thus loosening the sluice gates from their seats. Mud which had settled on top of the sluice gates was flushed off by a diver, and the sluice gates were slowly opened. Successive operation of the four 30-in gate valves and the sluice gates indicated that all were in working order. An inspection was made of both the sluice gates and the valves which indicated that all were in good condition and required only minor repairs. A detailed report on the inspection is included in Appendix A.

The capacity of the blow-off works with all three sluice gates and all four gate valves open is estimated at about 570 cfs. This is about 8.6 cfs per square mile of drainage area for the 66 square miles tributary to the Tomhannock Reservoir. A study of flow-duration curves on similar watersheds indicates that flows in excess of this figure may be expected only about 3% of the time. During the construction of the new spillway channel, it is proposed to draw the water level down about 8.5 ft, so as to provide storage capacity for a 4-in storm-water runoff. This can be accomplished in 8 to 10 days with all blow-off facilities open, but it may be desirable to reduce the rate of discharge somewhat to avoid excessive scour downstream from the dam. A 4-in storm-water runoff should be adequate to care for any storm which may reasonably be expected during the period of construction of the spillway channel.

Although the sluice gates and gate valves are operable, it is necessary to rehabilitate and reconstruct portions of the blow-off facilities. The gate house on top of the dam and the gate house which houses the 30-in gate valves at the toe of the dam must both be partially reconstructed. The sluice gate stems along the upstream slope of the dam are of 2.5-in steel on bronze rollers at 10-ft intervals. Each stem is made up of 10-ft bars with couplings and pins. The couplings are in good condition. The exposed ends of the pins are corroded badly, but it is not proposed to replace them at this time. There is some gravel around the stems which must be removed, so that it will not interfere with the free motion of the couplings. The sluice gates are of cast iron and appear to be bronze-mounted, and are provided with wedges.

The stilling pool at the downstream end of the blow-off must be provided with stone riprap so as to retard erosion and prevent undue undermining when the works are discharging water from the reservoir. The concrete headwall at the end of the blow-off system must also be restored.

Consideration was given to the necessity of cement lining of the 5-ft diameter steel pipe through the dam. This is a 1/2-in steel riveted pipe surrounded by massive concrete, and inspection of the interior revealed some very small leaks. The pipe should be cement lined, but this improvement can be deferred until other pipes in the system are cement lined.

The three sluice gates and four 30-in gate valves described above are hand operated. All are difficult to operate because of their size and age. We have given consideration to the installation of electric motor drives for operation of these gates, but are of the opinion that the relatively infrequent operation of these gates would not justify the cost of individual motor drives. However, considering the possibility that these gates may on occasion have to be operated quickly, which available personnel at the reservoir may be physically unable to accomplish, we recommend that a portable motor-driven gate operator, together with a suitable gasoline-engine-driven generator, be acquired. The estimated cost of this equipment includes an allowance for modifications to the existing gate stands to facilitate the use of the portable equipment.

The portable gate operator described above will also be available to operate the 6 sluice gates in the intake structure, which is discussed in the following section.

The estimated cost of the improvements to the blow-off facilities at Tomhannock dam as described above is $11,200, itemized as shown in Table 1.

TABLE 1. ESTIMATED COST OF IMPROVEMENTS TO BLOW-OFF FACILITIES

Improvements at Upper Gate House	$800
Work on Sluice Gates	500
Improvements at Lower Gate House	3,700
Portable Gate Operator	4,000
	$9,000
Contingencies and Engineering, 25%	2,200
	$11,200

2. Improvements to Tomhannock Intake Structure

The intake building presently contains no screening facilities of any kind. The need for screening is obvious, but because of the lack of such screening facilities, no operating experience is available on screening problems which may arise (volume of leaves, debris, small fish, microscopic organisms, etc.) It is not known, therefore, whether the installation of mechanical screens would be justified. There is not sufficient space within the present structure to install mechanical screens, and the cost of installing mechanical screens in an extension of the present intake structure would be very great and unjustified on the basis of present knowledge. It is therefore proposed that hand screens should be installed initially, and if future operating experience indicates that mechanical screens would be desirable, they can be installed as a part of the future overall program, probably at the new filtration plant, if one is constructed on the transmission main between Tomahnnock and the city.

As a part of the work required for the installation of the hand screens, it is proposed to have stoplogs constructed and inserted at both ends of the gate chambers, so that each chamber may be unwatered one at a time. While the chamber is unwatered, the guides for the hand screens will be installed. Two sets of screens will be installed with permanent lifting arrangement for both screens and stoplogs. It is proposed to remodel the building so as to provide a place for washing the hand screens and to provide necessary additional operating space. The existing wood roof shows evidence of dry rot and should be replaced. In connection with the roof replacement, hoisting provisions will be made for removing and washing the hand screens.

The outside openings for each of the three sluice gates in each chamber of the intake structure are provided with steel bar racks consisting of 1-inch round bars 4 inches on centers. These racks are reported to be badly deteriorated because of corrosion, and it is proposed to replace them all.

The six sluice gates are cast iron, bronze-mounted. At least one of the stems is completely corroded through. It is proposed to replace all of the stems and to examine and rehabilitate the sluice gates where required.

There are two dry feeders in the intake house which are used for feeding lime into the intake channels. These feeders have on occasion been out of service because of failure of the pump which provides solution water to the dry feeders. It is proposed to provide duplicate facilities for supplying water to the lime for feeding.

The retaining wall at the end of the building adjacent to the reservoir is badly deteriorated and must be reconstructed. We propose to restore this wall and provide additional protective riprap.

The estimated cost of construction of the improvements at the Tomhannock intake is $37,600, itemized as shown in Table 2.

TABLE 2. ESTIMATED COST OF IMPROVEMENTS TO TOMHANNOCK INTAKE

Two sets of stoplogs and lifting frame	$4,100
Hand screens, guides, lifting device, baffles and screen wash space	10,500
Replacing bar racks	2,000
Sluice gate inspection, repair and renovation, stem replacement, allowance	6,000
Riprap for erosion protection	2,000
Building improvements	4,500
Additional equipment	1,000
	$30,100
Contingencies and Engineering, 25%	7,500
	$37,600

3. Reconstruction of Tomhannock Spillway Channel

Description of Existing Channel

The existing spillway at Tomahnnock Reservoir is constructed of concrete with a crest 300 ft long at Elev. 390 U.S.G.S. base. The abutments provide a freeboard above the spillway crest of about 11 ft. The spillway itself is in good condition, except for a few places where the concrete has deteriorated. It is proposed to repair these places with gunite.

The channel downstream from the spillway section is comparatively level for a distance of about 800 ft and is unpaved. During floods, this reach of the channel forms a pool at relatively low velocity and is not subject to appreciable scour. It is proposed to remove the small trees which have grown up in this channel.

A county road crosses the spillway channel by means of a bridge approximately 850 ft downstream from the main spillway section. The channel is 80 ft wide under the bridge and is paved with concrete reinforced only with light wire mesh. The bridge is supported on concrete abutments with a clear height of about 10.5 ft above the paved channel. The bridge and the abutments appear to be in fair condition, although they are about fifty years old. Nothing is known of the foundations of the abutments. The concrete pavement in the bottom of the channel at the bridge is badly deteriorated and must be replaced. The top of the pavement under the downstream side of the bridge is at approximately Elev. 370, about 20 ft lower than the crest of the spillway itself.

At the downstream side of the bridge are granite masonry steps which drop vertically about 7 ft in a distance of about 17 ft. The tops of the concrete walls on either side of the 80-ft channel also slope down parallel with the slope of the steps. These granite steps have settled at some points indicating scour of the foundation, and the retaining walls show erosion near the junction with the steps.

Downstream from the above-mentioned masonry steps, the bottom of the channel was paved with concrete reinforced only with light wire mesh for a distance of about 136 ft within which the channel dropped only about 2 feet. The west wall and bottom pavement of this reach of the channel have been completely destroyed at the downstream end for about half the length. The wall on the west side is still in place, but both the wall and pavement are in very poor condition and must be replaced. The subgrade under the destroyed channel has been undermined to a depth of about 15 ft.

Just downstream from the aforementioned flat reach of channel was a second set of granite masonry steps which dropped a vertical distance of about

11 ft in a distance of 25 ft. These steps are almost completely gone, but the remnants are scattered in the bed of the eroded channel. The east retaining wall is still in place, but the west retaining wall is completely gone. Just downstream from this second set of granite steps was another reach of concrete paving about 50 ft long, the top of which was approximately at Elev. 350, or 40 ft lower than the spillway crest itself. This slab is practically all gone. The retaining wall on the west side is completely destroyed, and the retaining wall on the east side is about half gone.

Just downstream from the aforementioned slab was another set of granite steps which dropped a vertical distance of about 5 ft in a distance of 20 ft. The remnants of this set of steps are scattered in the bed of the stream.

Just downstream from the third set of steps was another concrete slab for a distance of about 35 ft. Most of this slab is destroyed. This slab approaches a concrete spillway section 80 ft long with its crest at Elev. 344. The west abutment of this section has been washed out, but the section itself can be repaired and used. This spillway section terminates the improved portion of the spillway channel. The natural channel downstream is comparatively flat.

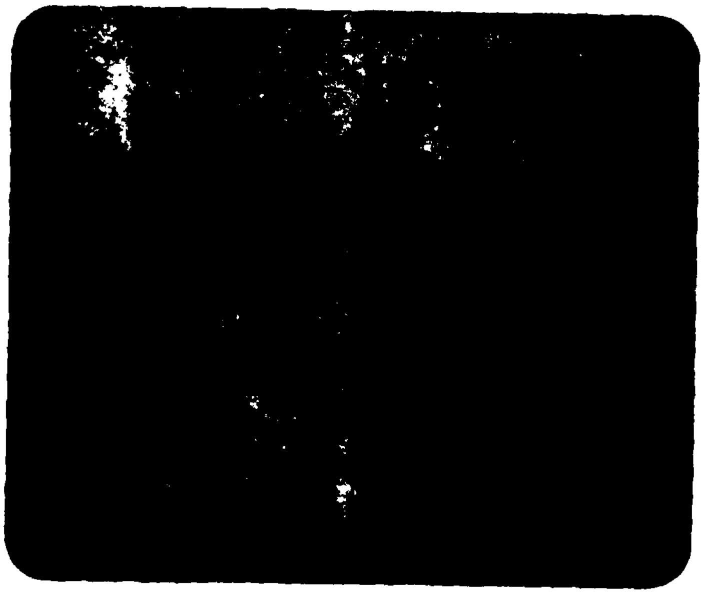
The accompanying photographs on Plate 1 illustrate the damage which has been done to the spillway channel. One set of these photographs was taken last summer, and the second set was taken this summer. They illustrate the amount of destruction which has taken place in a single year.

The subgrade of this channel is a hard mixture of clay, silt and gravel, which is stable at velocities of up to 6 to 8 fps characteristic of tranquil flow through pools but is easily eroded at velocities of 30 to 50 fps characteristic of supercritical flow downstream from controls. If repairs are not made to this channel at once, there is danger that the erosion may progress rapidly upstream and take out the bridge and the bridge abutments. A single major storm might accomplish this destruction. After the bridge and the bridge abutments are washed out, the erosion can progress upstream and menace the spillway itself. It is thus essential that this spillway be reconstructed at the earliest possible date. We strongly recommend that this reconstruction be accomplished before the 1959 spring runoff. This will require that the preparation of plans be started within about a month.

<u>Flow Capacity of Spillway Channel</u>

The 300-ft spillway section itself has a flow capacity of about 23,000 cfs, with an 8-ft head and a 3-ft freeboard at the top of the dike above the water surface. The flow capacity of the 80-ft spillway channel under the bridge is about 9,000 cfs

JULY, 1957

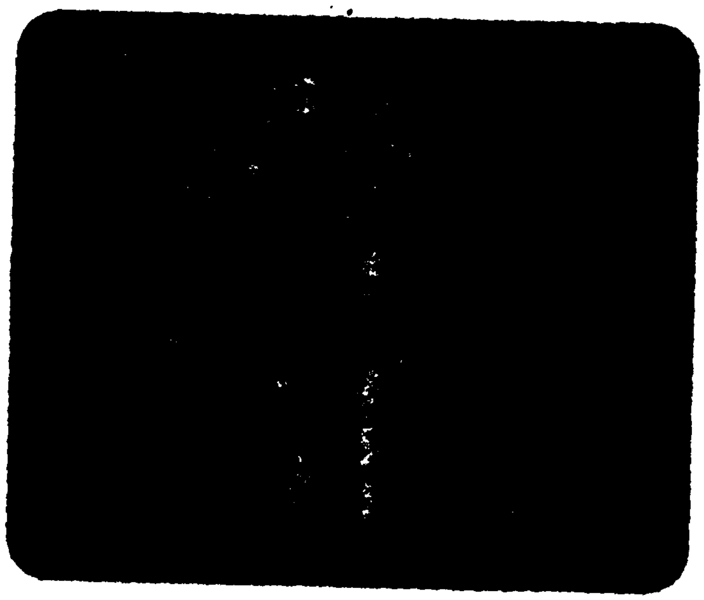


JUNE, 1958

VIEW LOOKING TOWARD EAST RETAINING WALL
APPROXIMATELY 160 FEET BELOW BRIDGE

Plate 1

JULY, 1957



JUNE, 1958

VIEW LOOKING TOWARD EAST RETAINING WALL
APPROXIMATELY 160 FEET BELOW BRIDGE

Plate 1A

or only about 40% of the capacity of the spillway section itself. It was necessary, therefore, to determine whether any capacity in excess of 9,000 cfs is required for the spillway channel in order to minimize the hazard of washout during major floods.

There are no records of actual flood flows in the existing spillway channel, but it is known that no flood was deep enough in the channel to touch the bottom of the bridge floor system. It is evident, therefore, that no flood as great as 9,000 cfs has occurred since 1906, a period of 52 years.

The U. S. Geological Survey Gaging Station on Poesten Kill at Troy, with a tributary area of 89 square miles, has been in operation since 1923. The greatest flood of record during this period was 11,900 cfs, which occurred on September 22, 1938, as a result of the hurricane. This runoff on the Poesten Kill watershed amounts to 134 cfs per square mile. The rainfall at Albany during this storm totaled 8 inches from September 17 to 21, inclusive, and was 6 inches for the last three days of the storm, being 1 inch on the 19th, 2 inches on the 20th, and 3 inches on the 21st. This total rainfall of 8 inches at Albany during the 1938 hurricane storm is to be compared with very much higher total rainfalls in the Catskills to the south and in the Berkshires and New England to the east. Numerous places recorded 12 to 15 inches, and the highest was 17.07 inches at Camp Buck, Connecticut.

A study of the rainfall during major storms in the eastern United States from October, 1869, to 1933 ("Storm Rainfall of Eastern United States", Technical Reports, Part V, The Miami Conservency District, Dayton, Ohio, 1936) reveals that the total rainfall in the Troy-Albany area during any one storm in this period did not exceed about 8 inches. Much higher total rainfalls were frequently experienced to the east in New England, and to the south in the Catskills and in Pennsylvania. The highest total rainfall during a storm in the Troy area since 1933 occurred during the 1938 hurricane storm. The New Year's storm of 1949 was accompanied by a total rainfall at Troy of about 7 inches, whereas the total rainfall in the Berkshires was about 10 inches. During this storm the peak rate of runoff in Poesten Kill was 10,100 cfs or 114 cfs per square mile.

The record since 1869 appears to indicate that the Troy-Albany area is protected from excessive rainfall and runoff during major storms such as occur to the south and to the east. Three major storms occurred during 1955 in the eastern United States, one on August 11-15, accompanying Hurricane Connie, another on August 17-20, accompanying Hurricane Diane, and the third on October 14-17. None of these storms produced severe flooding in the Troy-Albany area, but all of them produced excessive rainfall and severe flooding to the south and to the east, exceeding at some points all previous records. A total rainfall of 19.8 inches was recorded at Westfield, Massachusetts, during the August 17-20, 1955 storm, and a total rainfall of 13.29 inches was recorded at Stamford, Connecticut, during the October 14-17, 1955 storm.

The Hydrologic Services Division of the U. S. Weather Bureau has made comprehensive studies of all prior notable storms of record to determine their synoptic characteristics and the effect of topographic features and location on the moisture availability. Generalized charts have been prepared showing the probable maximum precipitation which may be expected at various points during 24 hours (Hydrometeorological Report No. 28). The chart for the New England-New York area indicates that the probable maximum precipitation for areas of 500 square miles during 24 hours is from 17 to 19 inches through Massachusetts and Connecticut. This is somewhat greater than the actual precipitation during the 1955 floods, as should be expected for probable maximums. These data are being used for the design of the spillways by the U. S. Corps of Engineers. The chart indicates, however, that rainfall as high as 16 inches in 24 hours may be expected as a probable maximum in the Troy-Albany area. Insofar as the Troy-Albany area is concerned, this practice appears to be much too conservative since there is no record of a total rainfall during a storm in excess of about 8 inches.

We have made flood-routing studies through Tomhannock Reservoir to determine the relations between peak rates of inflow to the reservoir and peak rates of discharge over the spillway, assuming the reservoir just full at the beginning of a storm. These studies indicate that with a peak rate of runoff into the reservoir of 12,000 cfs (182 cfs per sq mi), the peak rate of discharge in the spillway channel will be just under 9,000 cfs, the capacity of the existing channel. Thus the existing channel has a capacity about 35% in excess of any flood which has occurred during the past 100 years or so (134 cfs per sq mi on Poesten Kill).

The flood-routing studies indicate that with the present capacity of the main spillway section, 23,000 cfs, the peak rate of inflow to the reservoir will be approximately 32,500 cfs, or about 500 cfs per sq mi. Fig. 1 shows a plot of major New England floods prepared by Mr. Howard M. Turner, Consulting Engineer of Boston. Shown on this figure is an envelope curve based on the Myers' Flood Formula with a coefficient of 40%. This curve includes most of the floods of record. We have shown in red on the graph the inflow capacity of the present spillway section. It will be noted that it is on the 40% Myers' Curve. The Poesten Kill flood of 1938 is also shown on Fig. 1, together with the inflow capacity of the existing spillway channel.

In view of the wide divergence in capacity between the spillway dam and the existing spillway channel, consideration has been given to increasing the capacity of the spillway channel when it is reconstructed. An increase in the width of the channel from 80 ft to 130 ft will increase the flow capacity to 14,600 cfs with the same water depths. Flood-routing studies indicate that this rate of discharge at the spillway corresponds with a peak rate of inflow of about 20,000 cfs, or 300 cfs per sq mi. This rate of inflow is also shown on Fig. 1.

In view of the fact that no flood has occurred in the Troy-Albany area during the past 100 years or so which would require more than about 75% of the capacity of the existing spillway channel at Tomhannock Reservoir, we are of the opinion that the city will assume no great hazard if the channel is reconstructed with the same capacity. We have therefore prepared preliminary designs and cost estimates on this basis. If, however, the City should elect to provide a larger capacity, we have also prepared alternate preliminary designs and cost estimates for a channel 130 ft wide.

Proposed New 80-ft Spillway Channel

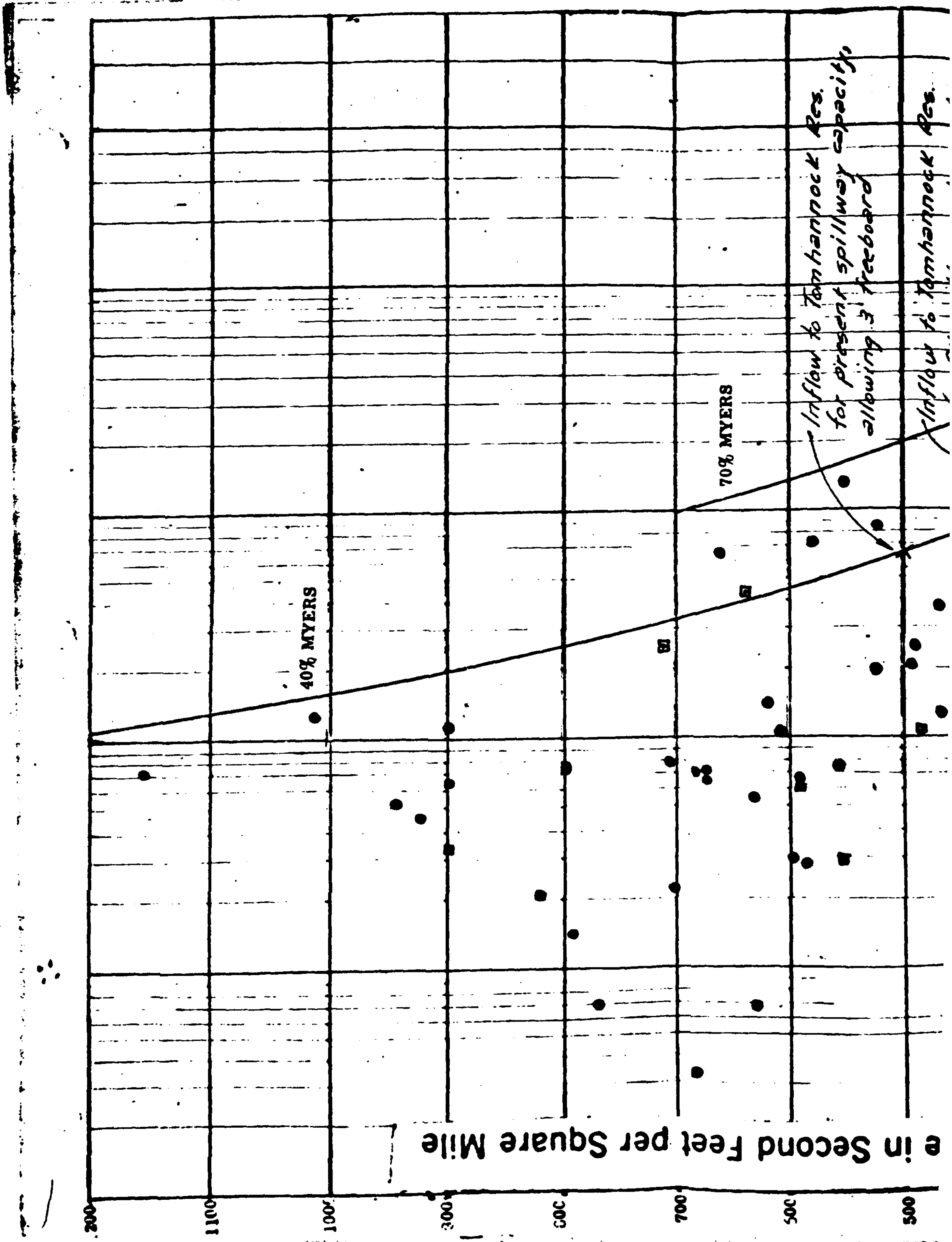
The proposed new 80-ft spillway channel is shown in plan and profile on Fig. 2. The top of the east retaining wall downstream from the bridge is shown on the profile by means of a light broken line. This broken line is continued beyond the end of the portion of the retaining wall still in place to indicate the elevation of the ground at the position once occupied by the destroyed portion of the retaining wall. Also shown on the profile by means of light broken lines downstream from the bridge is the top of the pavement and the granite steps as they once existed. Also shown on the profile by means of light broken lines is the ground surface along the position once occupied by the west retaining wall. It will be noted that the subgrade has been scoured out along this line to an elevation of about 340.

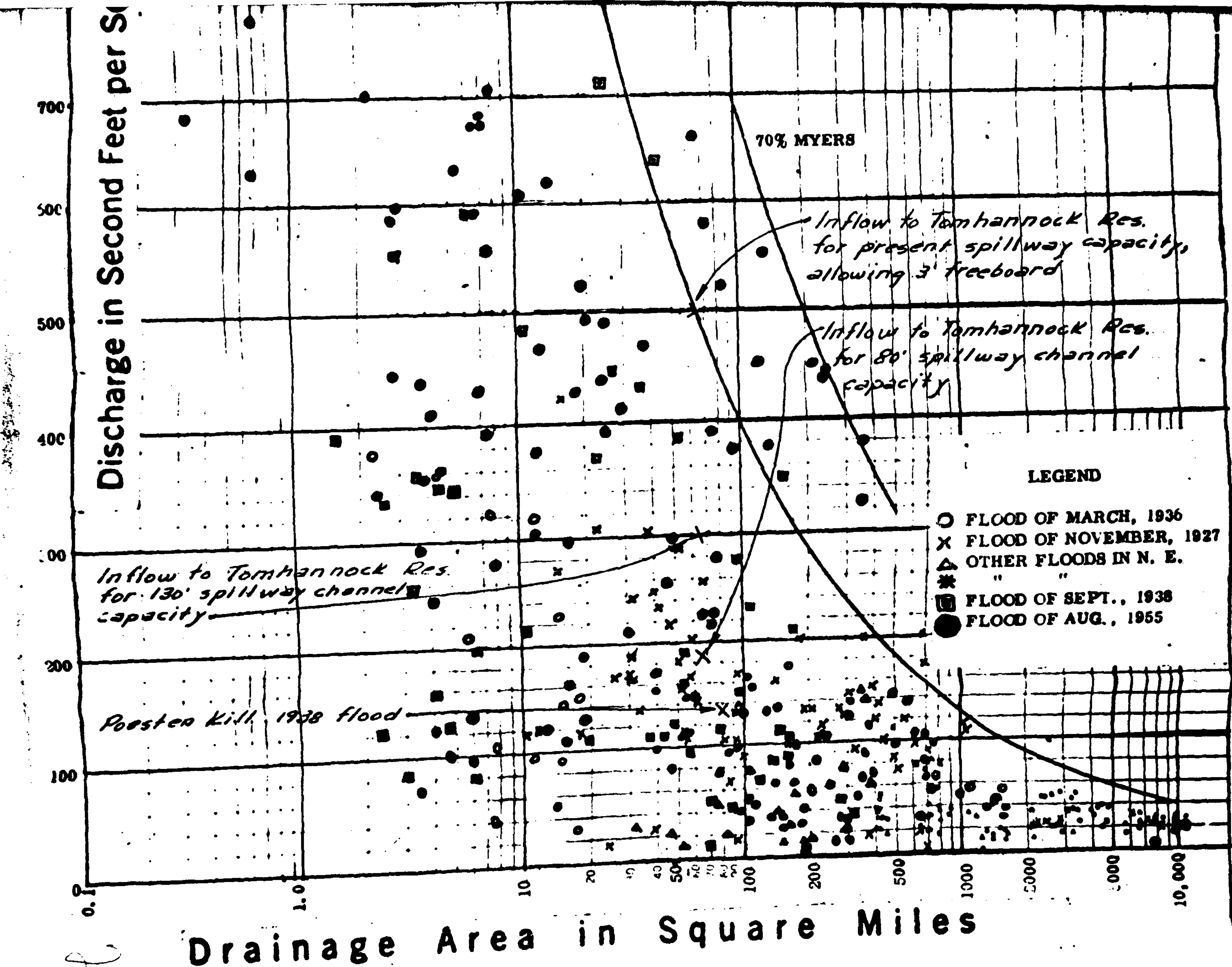
It is proposed to replace the existing concrete slab with a new reinforced concrete slab under the bridge, the elevation of the top of which will be 370 on the downstream side of the bridge. It is proposed to replace the first set of granite steps with a reinforced concrete slab and to extend this slab downward on a slope of about 3 vertical to 8 horizontal for a distance of about 80 ft and thence to curve it gently into a horizontal bottom slab at Elev. 340. This level bottom slab will extend another 215 ft to the existing ogee spillway section at the end of the improved channel.

The side walls will be replaced by new reinforced concrete side walls as shown on the plan and profile, the walls being 20 ft high at the downstream pool. The walls will be 80 ft apart for a distance of about 205 ft downstream from the bridge and will converge at this point so as to be 54 ft apart at the existing ogee spillway at the end of the improved channel.

The computed hydraulic profile for a flow of 9,000 cfs in the proposed channel is shown by means of a light solid line on the profile. This computed water surface is based upon the assumption that the existing ogee spillway at the end of the improved section will act as a control for the water depth upstream. Its function as a control can be assured by some clearing and grading of the channel downstream.

The hydraulic profile consists of three controls: the spillway section itself, the top of the slope at the bridge, and the ogee section at the end of the improved channel. The flow passes from low velocity tranquil flow to shooting flow at higher


Inflow to Tomhannock Res.
for present spillway capacity,
allowing 3' freeboard
Inflow to Tomhannock Res.
70% MYERS
40% MYERS
e in Second Feet per Square Mile
200
1100
1000
300
600
700
500
500



PEAK FLOWS OF NEW ENGLAND STREAMS FIG

velocity through each of these controls and is followed by a "hydraulic jump" into a stilling pool at low velocity.

The stilling pool upstream from the bridge will range in depth from about 10.5 ft to about 14 ft. The velocity in the pool at a flow of 9,000 cfs will range from about 7 to 9.4 fps. The velocity at the control just downstream from the bridge will be about 15.2 fps and the depth will be about 7.2 ft. The depth will decrease rapidly down the sloping bottom to about 2.25 ft near the bottom of the slope, and the velocity will increase rapidly to a maximum of about 49 ft per second. The jump will occur near the bottom of the slope to a depth of about 17.5 ft through the downstream pool. The velocity in this pool will be about 6.4 fps.

The purpose of the hydraulic jumps at the upstream ends of the stilling pools is to dissipate the kinetic energy of the water which is developed by the fall over the control sections. About 11 ft of head will be dissipated in the first hydraulic jump in the stilling pool just downstream from the spillway section, and about 21 ft of head will be dissipated in the hydraulic jump just downstream from the sloping bottom below the bridge. Another hydraulic jump of small magnitude will occur just downstream from the ogee section at the end of the improved channel.

Since the hydraulic capacity between the bridge abutments and under the existing bridge is adequate for a design capacity of 9000 cfs, it is not necessary from the City's viewpoint to replace the abutments and the bridge. This structure is over 50 years old, however, and has capacity for only one lane of traffic. If it is to be replaced in the not-too-distant future, it should be replaced during the reconstruction of the spillway channel so that the abutments can be integrated with the bottom slab. The City should confer with the county authorities to determine whether the county desires to replace the bridge during the construction of the spillway channel.

If the bridge is replaced, it should undoubtedly provide for two lanes of traffic and for heavier loads. Consideration should also be given to increasing the height of the abutments about 3 ft so as to provide additional flood capacity. This cannot be done safely with the present abutments because nothing is known about the footings.

The estimated cost of construction of the proposed 80-ft spillway channel is $320,400, itemized as shown in Table 3.

Alternate 130-ft Spillway Channel

The alternate 130-ft spillway channel is shown in plan and profile on Fig. 3. This alternate requires a completely new bridge, new bridge abutments and a new bridge pier in the middle of the channel. It also requires a widening

TABLE 3. ESTIMATED COST OF CONSTRUCTION OF 80-FT SPILLWAY CHANNEL

Structure Excavation	10,700 c.y.	@	$2.00	$21,400
Earth Fill	7,600 c.y.	@	0.75	5,700
Compacted Gravel	2,600 c.y.	@	3.00	7,800
Remove and Dispose of Existing Concrete Masonry & Rubble	L.S.			20,000
Class 1 Concrete (Walls, etc.)	1,000 c.y.	@	60.00	60,000
Class 2 Concrete (Slabs)	1,760 c.y.	@	40.00	70,500
Reinforcing Steel	152 tons	@	280.00	42,500
Underdrains	900 l.f.	@	4.00	3,600
Loam and Seed	2,000 s.y.	@	0.50	1,000
Clearing	L.S.			2,000
Paved Ditch for Existing Culvert	L.S.			1,000
Fencing	700 l.f.	@	5.00	3,500
Riprapped Slopes	1,400 s.y.	@	5.00	7,000
Repairs to Present Spillway	L.S.			10,000
Miscellaneous Work				
Access to Work	$2,000			
Flexible Const. Joints	2,000			
Protection of Works	3,000			
Handling Drainage	2,000			
Misc. & Cleaning Up	2,000			11,000
				$267,000
Contingencies and Engineering, 20%				53,400
Total				$320,400

of the upstream pool, new approaches to the new bridge and a relocation of the road on the west side of the upstream pool.

In this alternate, the channel for the downstream pool will converge from the 130-ft width to a width of 90 ft at the ogee spillway section at the downstream end of the improved channel. This will require an addition at one end of the ogee spillway section.

The elevations of the tops of the bottom slabs and walls will be the same as for the 80-ft channel. The capacity of the 130-ft channel is estimated at 14,600 cfs, which corresponds with a peak rate of flood inflow to the reservoir of 20,000 cfs or 3000 cfs per square mile of watershed. The hydraulic profile will be the same downstream from the existing spillway section as for the 80-ft channel with depths and velocities essentially the same. The estimated cost of construction of the 130-ft channel complete, including the bridge and abutments and improvements to the road, is $535,000, itemized as shown in Table 4.

4. Desilting Quacken Kill Diverting Reservoir

The Quacken Kill Diverting Reservoir on Quacken Kill diverts the water from the Grafton supply into the distribution systems serving the upper high service and the high service areas. This reservoir has a capacity of only about 3 mg whereas the supply taken from this source amounts to about 4.5 mgd. This reservoir is subject to heavy pollution loads resulting from the runoff along the roads and the supplying stream between the Martin-Dunham Reservoir and the diverting dam. Silt and leaves are washed into this reservoir and most of it deposits on the bottom except during heavy runoffs.

Soundings have been made of the silt deposits on the bottom of the diverting reservoir and samples of water and silt deposits have been collected and examined. The silt appears to be a mixture of topsoil and leaf and twig fragments. The top of the silt in the reservoir was found to be very light and fluffy and was easily placed in suspension by means of an oar passed slowly above it. It is thus subject to scour and movement from place to place within the reservoir by means of convection currents and currents due to increased flow during rainstorms. This silt is undoubtedly carried into the supply pipe from time to time.

Table 5 shows the results of analyses of two water samples collected on June 5 and 6, 1958, one just upstream from the Quacken Kill Diverting Reservoir and the other at the entrance to the supply main. The stream flow at this time was approximately 60 cfs or about 4 cfs per square mile for the tributary area of 17 square miles. This flow is probably about twice the

TABLE 4. ESTIMATED COST OF CONSTRUCTION OF 130-FT SPILLWAY CHANNEL

Common Excavation	13,600 c.y.	@	$0.50	$7,300
Structure Excavation	18,000 c.y.	@	2.00	36,000
Earth Fill	12,900 c.y.	@	0.75	9,675
Compacted Gravel	3,800 c.y.	@	3.00	11,400
Remove & Dispose of Existing Masonry	L.S.			20,000
Class 1 Concrete (Walls, etc.)	1,560 c.y.	@	60.00	93,600
Class 2 Concrete (Slabs)	2,760 c.y.	@	40.00	110,400
Reinforcing Steel	238 tons	@	280.00	66,640
Underdrains	1,300 l.f.	@	4.00	5,200
New Bridge	L.S.			32,000
Loam and Seed	6,600 s.y.	@	0.50	3,300
Riprapped Slopes	2,000 s.y.	@	5.00	10,000
Clearing	L.S.			2,000
Paved Ditch for Existing Culvert	L.S.			1,000
Road Paving (including Gravel Base)	1,600 s.y.	@	3.00	4,800
Fencing	700 l.f.	@	5.00	3,500
Repairs to Existing Spillway	L.S.			10,000
Miscellaneous Work				
Access Work	$2,000			
Flexible Constr. Joints	2,000			
Protection of Works	3,000			
Handling drainage	2,000			
Misc. & Cleaning Up	2,500			
Temp. Road Crossing	5,000			
Removal of Bridge	1,000			
Guard Rails on Road	1,500			19,000
				$445,815
Contingencies and Engineering, 20%				89,163
				$534,978
Total, say				$535,000

mean flow, and will be exceeded about 10% of the time or 36 days per year on the average. The weather was good during the period of collection of the samples. The analyses indicate a slight pickup in turbidity as the water passes through the reservoir and a considerable pickup in total solids. This indicates some scour from the top of the sediment in the reservoir.

TABLE 5. ANALYSES OF WATER SAMPLES
COLLECTED FROM QUACKEN KILL RESERVOIR
JUNE 5-6, 1958

	Above Reservoir	At Screen House
Free NH_3	0.040 ppm	0.040 ppm
Albuminoid	0.12	0.16
Kjeldahl	0.17	0.22
NO_2	.000	.000
NO_3	0.10	0.10
Color	25	29
Turbidity	2	4
Total Solids	33	43

Figure 4 shows a plan of the reservoir with shaded areas shown at various cross sections of the reservoir to indicate the depth of sediment at the cross sections as determined by the soundings. The volume of the sediment is estimated at approximately 123,000 cu ft and an analysis of the sediment indicates that it contains approximately 27.5% of solids by weight. Our studies indicate that this sediment is the accumulation of several years. The removal of this sediment should result in a temporary improvement of the water quality, but there is a question as to whether this temporary improvement is worth its cost for the reasons given below.

From a study of flow duration curves of similar small streams, we estimate the mean flow at the diversion dam at about 17 mgd, the flow to be exceeded 10% of the time at about 44 mgd, the flow to be exceeded 5% of the time at about 66 mgd, the flow to be exceeded 1% of the time at about 121 mgd, and the five-year flood at about 1470 cfs. The detention periods and mean velocities through the diversion reservoir for these flows are estimated at 4 hours and 1 fpm, 1.6 hrs and 2.5 fpm, 1.1 hrs and 3.8 fpm, 36 minutes and 7 fpm, and 5 minutes and 1 fps respectively. Based on these figures, we believe that at least 5% of the time the influent to the reservoir will be of poor quality and will have inadequate settling in the reservoir. Where the flow decreases below the 5% flow settling will improve and both influent and effluent will clear; but when

the flow increases above the 10% flow material previously settled will be picked up. Hence the improvement in water quality to be effected by removal of the deposits may turn out to be of very short duration.

If a filtration plant is constructed for the Tomhannock supply, it is probable that filtered Tomhannock water will be pumped into the high service and upper high service areas and that the Grafton supply will be held in reserve until needed in the distant future. At that time, it is probable that water from the Grafton supply will be diverted directly onto the Tomhannock watershed. The sediment in the water from the Grafton supply will be of no importance in this case.

If the City elects to clean the diverting reservoir for a temporary improvement in the water quality, we recommend that the sediment be removed by means of a pump mounted on a raft to take suction through a hose lowered into the sediment and to discharge through another hose into the stream downstream from the spillway. This work should be done during the spring runoff just after the ice has gone out at which time the flow should be higher than the mean flow. We recommend that the sediment be pumped during a period of about thirty 8-hour working days provided the stream flow at the reservoir is not less than about 30 mgd. Under these conditions the suspended solids in the water downstream from the spillway should average about 900 parts per million during the 8-hour pumping periods. The water will clear up during the 16-hour period each day when the pump is not in operation and it will be clear over the weekends. A pump having a capacity of about 500 gpm will be required, with the suction hose lifted at frequent intervals so as to pump clear water for flushing.

Quacken Kill flows southwesterly for a distance of about 7 miles from the diverting reservoir where it discharges into Poesten Kill. It is a rapidly flowing stream dropping about 425 ft in the 7-mile distance. Poesten Kill flows westerly for a distance of about 9 miles from the mouth of Quacken Kill to discharge into the Hudson River at Troy.

We have examined into the possibility of damage to fish life by the high turbidity caused by the pumping of the sediment from the reservoir downstream into the stream itself. Studies reported by Clarence M. Tarzwell of the Robert A. Taft Sanitary Engineering Center at Cincinnati show that the turbidity must be very high before it exerts a directly harmful effect on fishes. In some tests direct reaction to turbidity did not appear until it reached 20,000 ppm and for one species not until it reached 100,000 ppm. Most individual fishes of all species endured exposure to more than 100,000 ppm for a week or longer, but finally died at turbidities of 175,000 to 225,000 ppm. If the sediment in the diverting reservoir is pumped as proposed, the turbidity downstream therefrom should not exceed about 1,000 ppm. Inasmuch as the sediment is composed entirely of matter which flows in the stream upstream from the reservoir, there is no reason to suppose that it would be harmful to fish life in any other way

than as exhibited by the concentration. If the City elects to pump the sediment out of the reservoir into the stream, permission to do so should be obtained from the proper state authorities.

During the period of pumping sediment from the diverting reservoir it will be ncessary to take water upstream therefrom because the pumping operations will stir up the sediment and make the water in the reservoir unfit for drinking. It is proposed to construct a small temporary dam about 1400 ft upstream from the screen house and a temporary pipeline therefrom on top of the ground to discharge into the screen house just upstream from the screens. The sluice gates at the gate house will be closed entirely during the pumping operation and water in excess of the demand will be discharged into the reservoir and over the spillway. It is proposed to have a pipeline capacity of about 8 mgd, so as to have a flow in excess of the peak rate of draft. The proposed temporary dam will be of rock-fill construction with the top at about Elev. 870 which is 12 ft higher than the elevation of the spillway of the diverting dam. Thus, 12 ft of head will be available for flow in the temporary pipeline. A single 20-in pipeline or two 16-in pipelines, 1400 ft long, will be required during the cleaning operations. The estimated cost of the temporary works and the cleaning operations is $33,750, itemized as shown in Table 6.

TABLE 6. ESTIMATED COST OF DESILTING
QUACKEN KILL DIVERTING RESERVOIR

Diversion dam, construction and removal	$4,000
Temporary bypass pipe (20") 1400 ft long	7,000
Use of barge, pump, discharge pipe and other equipment for silt removal over 30-day period	16,000
	$27,000
Contingencies and Engineering, 25%	6,750
	$33,750

Consideration was given to an alternate method involving the diversion of the entire flow of the stream around the reservoir and removal of the silt by pumping it into trucks and hauling to a suitable dumping area. This method is more expensive and is considered not feasible because of high stream flows during freshets.

Consideration was also given to removal of the silt by dragline and hauling away by truck, keeping the diverting reservoir pumped out during the silt-removal operations. This operation could best be accomplished during a dry period in the

summer when the stream flow could be controlled at a minimum, except during freshets. This method is approximately equal in cost to the proposed method, but is not recommended because of difficulties that would be encountered with high stream flows during freshets. Neither of the two alternate plans described above would guarantee against the discharge of silt into the stream below the dam.

5. Improvement of Chlorination Facilities at Quacken Kill Diverting Reservoir

All of the water for the upper high service area and most of the water for the high service area is taken into the distribution system at the Quacken Kill diverting dam. This water is subject to occasional high counts of coliform bacteria because of sewage pollution on the Quacken Kill upstream from the dam. The chlorination facilities at this dam are, therefore, extremely important for the protection of the consumers against infections by intestinal disease germs. Ineffectual disinfection or a lapse in operation of the chlorinating facilities should not be tolerated.

In order to insure continuous and effective operation of the chlorinating facilities, improvements are required at this station. These improvements include an addition to the building for the operator in attendance which is completely separate from the chlorine room and not subject to the hazards of leaking chlorine. Toilet facilities are also required. Additional heating facilities are required to supplement the existing electric system which is inadequate in extremely cold weather to prevent the freezing of small water pipes which are used for flushing the screens. In the event of power failure the loss of heat from the existing electric heaters might result in disruption of chlorination. Better pumping and screening facilities are also required on the water supplied to the chlorine machines so as to insure proper functioning of these facilities. Other improvements are required in the building to prevent the leakage of chlorine to the lower floor and to properly vent the lower floor. A new sampling pump and piping is required to permit the taking of samples from the supply line downstream from the dam for chlorine residual tests at the station.

The estimated cost of construction of the improvements required for the chlorination facilities at the Quacken Kill diverting reservoir is $12,600, itemized as shown in Table 7.

TABLE 7. ESTIMATED COSTS OF IMPROVEMENTS TO CHLORINATION FACILITIES AT QUACKEN KILL AND VANDERHEYDEN RESERVOIRS

Quacken Kill	
Building Additions	$4,600
Additional Equipment	5,500
	$10,100
Contingencies and Engineering, 25%	2,500
	$12,600
Vanderheyden	
Building Additions	$11,000
Additional Equipment	3,600
	$14,600
Contingencies and Engineering, 25%	3,700
	$18,300

6. Improvement to Chlorination Facilities at the Vanderheyden Reservoir

The Vanderheyden Reservoir which delivers water to the high service area is also subject to occasional sewage pollution. The chlorinating facilities at this station are therefore of equal importance to those at the Quacken Kill diverting reservoir and must be kept in continuous satisfactory operation.

A new addition is required to this building to provide toilet facilities and to provide additional storage room for lime. A supplementary heating system is also required for this station to provide heat in the event of power failure. Improved standby pumping facilities are required for the chlorine solution water. A sump pump is required for the Venturi pit and a sampling pump and line are required to permit sampling of the water for chlorine residual tests.

The estimated cost of construction of the improvements needed at the Vanderheyden chlorination station is $18,300, itemized as shown in Table 7.

Conclusions and Recommendations

Our conclusions and recommendations are summarized in the letter of transmittal at the beginning of this report.

TROY, NEW YORK

REPORT ON IMPROVEMENTS TO WATER SUPPLY

APPENDIX A

Report of Inspection of Controls for Permanent Opening Through Dam

Tomhannock Reservoir

June 23, 24, 25, 26, 1958

June 23. In the afternoon the five-foot diameter riveted steel pipe was filled by means of a 3-in Homelite pump taking suction from the reservoir and discharging through a fire hose connected to the southwest 4-in valve on the header on the discharge end. Pressure was built up to 15 psi at the header and the 4-in valve closed.

June 24. McComber and Crosby, divers, were on the job. Pressure was built up to 25 psi in the 60-in pipe, (3 psi over static) which unseated the valves, causing air trapped under them to bubble to the surface. A rock with a line tied on was dropped over the bubbles as a guide for the diver, and the pump stopped. A small barge used to treat the reservoir with copper sulfate was made fast between the shore and the line to the valve. The diver followed the line down and by again starting the Homelite pump to force air out, he was able to find the location of the valves. He found the first pier on the valve stem and transferred the line from the rock to the northeast valve (No. 1) stem. Inspection showed that silt had built up level with the head wall and was packed too hard to get to the valves. Anticipating this condition, a fire pumper was on the job and the diver had brought a jetting nozzle to be used under water. By using the above, he was able to loosen the silt on the valves, but had trouble getting rid of the material due to its settling back on the valves. He loosened the hard packed silt to a degree that the southwest valve (No. 3), which was the one everyone agreed could be operated, was cleared. The diver came up. Pressure was built up within the pipe to 25 psi and No. 3 sluice gate opened 300 turns. Static pressure at the discharge header was 22.2 psi. The southwest 30-in gate valve (No. 1) was cracked, closed, then fully opened. Pressure in the discharge header dropped to 2 psi with a flow estimated at approximately 80 cfs. The 30-in gate was closed after allowing water to flush about 10 minutes at full discharge. While flushing, the pumper was started in order that the unattended nozzle could stir up silt in the vicinity of the sluice gates.

June 25. The diver went down and made an inspection of the opened sluice gate. The hose and nozzle had been drawn into the gate while flushing. This was withdrawn with some difficulty and more jetting done to clear up the area, the mud being jetted into the opened gate. An inspection was made of sluice gate No. 3 (attached). There was still too much silt to properly inspect No. 1, which was reported to have a broken stem.

The cement bags reported to have been placed on the gates were found neatly stacked under the stem of No. 2 sluice gate.

The diver came up, No. 3 sluice gate was closed and leakage determined by cracking a 4-in valve and observing the pressure drop. No. 1 sluice gate was opened 224 turns without difficulty after raising the unseating pressure of 25 psi. 30-inch gate valve No. 2 was fully opened, as before, flushed, and closed. The diver descended and made an inspection, finding all of the gates clear of silt, and sluice gate No. 1 open. Everything seemed to be in order, sluice gate No. 3 was completely closed, so the diver proceeded to inspect the stems up to the point they entered the gate house substructure. He found sediment piled too deep and too hard to inspect the stems between piers 7 and 8 and from pier 8 to the gate house substructure. When he came out, sluice gate No. 1 was closed.

June 26. The diver went down with the hose to try and clear sediment away from the stems at the upper end. The nature of the material was such that it would fall right back after jetting. The diver said he was not getting anywhere so he came up. He brought up a handful of material about 1/16" in size resembling stone chips or dust. He said the material would have to be removed by suction hose or an air lift. Gate No. 1 was closed and leakage checked.

The opening of sluice gate No. 2 was begun after raising the unseating pressure as before. After opening 109 turns it stuck. The valve was closed 30 turns and opened 34; closed 10 and opened 14; closed 5 and opened 8, making a total of 120 turns opened. When closing, the wheel spun freely. The diver went down to see if the stem coupling was catching on cement bags or if something was in the way of the gate, but found everything in order. While he observed the gate, the wheel was turned in a closed direction to check if the valve was closing. Everything seemed in order. The diver came up and the gate was opened a total of 250 turns by alternately opening and closing. The 30-inch gate valves, No. 3 and No. 4, were both cracked, closed, then half opened, allowed to flush and were closed. Sluice gate No. 2 was closed and leakage checked by cracking one 4-in valve and observing the pressure drop. Leakage was negligible.

An inspection of the outer face of the headwall where it extended above sediment (silt) revealed cribbing which may have been forms or possibly a working platform for the original gates. Silt was too high to discover if the original gates were still there.

Diving was under the immediate direction of J. McComber, Marine Diving Contractor, 82 Williamson Avenue, Jersey City 5, New Jersey. Underwater work was done by James Crosby, 1585 White Plains Road, Bronx 62, New York.

INSPECTION -- SLUICE GATES AND STEMS

Gates	Cast iron, bronze mounted. Metal in casting makes solid noise when struck with hammer. Seats are smooth and tigh Wedges are in good shape, stem and nuts on stem are sound as determined by hammer blows. There is about 1/8" o rust on the stem. Construction is similar to that shown on Ludlow drawing #2675. All valves seemed in excellent co dition and workable.		
Stems at Gates	All stems in good condition with at least 2" of metal after scraping off tuberculation. Tubercules are typical, about 3 in height. Couplings are in good condition; metal feels smooth and may be bronze. Tapered rectangular steel pins with keeper r through hole in narrow end are in poor condition where exposed and crumble in diver's hand. Pins on coupling on gat are flush, gate #2 stick out about 1/16" and gate #3 stick out about 1/2" and still have rings similar to a key ring in a drilled hole.		
	Northeast (No. 1)	**Center (No. 2)**	**Southwest (No. 3)**
	2 couplings to pier #1. Coupling nearest valve can put finger in pin hole.	2 couplings to pier #1. Pins in bad shape (1/16" out from collar). Cement bags piled under stem between couplings.	2 couplings to pier #1. Pins exten about 1/2".
Pier No. 1	Pier all right. Roller and keeper all right. Stem on bronze roller, keeper 2" above stem.	Pier all right. Roller and keeper all right. Stem on bronze roller, keeper 2" above stem.	Pier all right. Roller and keeper right. Stem on bronze roller, kee 2" above stem.
	No coupling.	No coupling.	No coupling.
Pier No. 2	Pier all right. Roller and keeper all right. Stem on roller.	Pier all right. Roller and keeper all right. Stem on roller.	Pier all right. Roller and keeper right. Stem not resting on roller. Stem against keeper.
	Coupling 1 ft from pier #3. Pins protrude 1/16" from coupling and are in bad shape.	Coupling 2 ft from pier #2. Pins in bad shape.	Coupling 2 ft from pier #2. Pins bad shape.
Pier No. 3	Pier all right. Roller and keeper all right. Stem on roller. Keeper about 2 inches above stem. About 10" of mud on inshore face of pier.	Pier all right. Roller and keeper all right. Stem on roller. Keeper about 2 inches above stem. About 10" of mud on inshore face of pier.	Pier all right. Roller and keeper right. Stem on roller. Keeper 2 above stem. About 10" of mud on inshore face of pier.
	No coupling.	No coupling.	No coupling.

	No. 1	No. 2	No. 3
Pier No. 4	Pier all right. Roller and keeper all right. Stem on roller, keeper about 2" above stem.	Pier all right. Roller and keeper all right. Stem on roller, keeper about 2" above stem.	Pier all right. Roller and keepe right. Stem on roller, keeper al 1-1/2" above stem.
	Coupling. Pins in very poor condition. Mud covers stem and coupling.	Coupling. Pins in poor condition. Mud covers stem and coupling.	Coupling. Pins in poor conditio Mud covers stem and coupling.
Pier No. 5	Stem on roller. Keeper 2" above stem. Mud around stem.	Stem on roller. Keeper 2" above stem. Mud around stem.	Stem on roller. Keeper 2" abov Mud around stem.
	Stem in mud. No coupling.	Stem in mud. No coupling.	Stem in mud. No coupling.
Pier No. 6	Stem on roller. Keeper 2" above stem. Mud around stem.	Stem on roller. Keeper 2" above stem. Mud around stem.	Stem on roller. Keeper 2" abov Mud around stem.
	Coupling. Pins in bad condition. Stem in mud.	Coupling. Pins in bad condition. Stem in mud.	Coupling. Pins in bad condition. in mud.
Pier No. 7.	Stem on bronze roller Keeper 2" above stem.	Stem on bronze roller. Keeper 2" above stem.	Stem on bronze roller. Keeper above stem.
	Stem buried in mud.	Stem buried in mud.	Stem buried in mud.
Pier No. 8	Mud flush with inshore side.	Mud flush with inshore side.	Mud flush with inshore side.
	Solid mud.	Solid mud.	Solid mud.
Headwall. Gate house Substructure.	Stem buried in mud where enters wall.	Stem buried in mud where enters wall.	Stem buried in mud where enters wall.

*While closing gate No. 3, the wheel was turned about 30 times more than it was opened, causing the stem to be buckled at this point. This fact was discovered upon examination of the threaded portion of the stem at the gear in the gate house.

August 3, 1926.

Dam 110
Upper Hudson
Schaghticoke.

Bureau of Water,
Troy, New York.

Gentlemen:

An application has been made to the State Engineer and five prints in duplicate have been received, number one to five, inclusive and marked "Repair of Tomhannock Spillway" for the reconstruction by you of the Tomhannock reservoir dam. This dam has been designated by this Department as Dam No. 110, Upper Hudson Watershed.

You are hereby given permission to December 1st, 1926, insofar as the matter involves the jurisdiction conferred upon this department by chapter 647, laws of 1911, section 22, as amended, to reconstruct the above dam according to the five prints submitted, under the following conditions:

1. That another set of the above five prints be forthwith sent to this department.

2. That you notify Division Engineer R. D. Hendricks, Journal Building, The Plaza, Albany, N. Y., one week in advance when any section of the present dam will be cleaned and ready for concrete erection.

3. That a report be submitted to this department by your engineer, as soon as ascertained, for any section, on the depths of the un-reinforced cutoff which supports the down stream end of the reinforced slab and on the character of and the depths penetrated into its natural bed; on the depths of the upstream sheet piling cutoff and on the character of this bed; and on the depths and the thicknesses of the abutments and of the core walls and the character of their natural beds.

4. That the tile drain on the embankment side of the abutment be omitted on the upstream side of the core wall.

Dam 110 - Upper Hudson - Schaghticoke

Owned by City of Troy.

Plans on file in Map Filing Cabinet.

[illegible]

[illegible]

Dam #110

[illegible] FILED IN

[illegible] HUDSON [illegible]

[illegible]

Dam 110 - Upper Hudson - [illegible]

Owned by City of Troy

Plans on file in Map File Cabinet [illegible]

August 26, 1926.

Dam 110 U.Hud.
Schaghticoke

Bureau of Water,
Troy,
N. Y.

Gentlemen:

The sample of sand received at our laboratory on August 19th and submitted for use in the concrete of the Tomhannock Reservoir Dam has been tested.

The results indicate that this sand should be satisfactory for use in this work. Attention should be called to the fact that since more than 10 percent of the sample passes a number four sieve the coarser portion of the sand should be considered as gravel.

Yours very truly,

Roy G. Finch,
State Engineer.

By

Assistant Deputy

ARMcK/ECH

E. D. HENDRICKS, Division Engineer

STATE OF NEW YORK
DEPARTMENT OF STATE ENGINEER AND SURVEYOR
EASTERN DIVISION
JOURNAL BLDG.
ALBANY

SUBJECT:

August 26, 1926.

Hon. Roy G. Finch,
State Engineer,
Albany, N. Y.

Dear Sir:-

Enclosed you will please find report of results of tests of a sample of sand from a bank at Johnsonville, N. Y., submitted as proposed for use in the repairs to the spillway of the Tomhannock Reservoir of the Waterworks system of the City of Troy, N. Y.

These results indicate that this sand should be satisfactory for use in this work. Attention should be called to the fact that, since more than ten per cent of the sample passes a #4 sieve, the coarser portion of the sand should be considered as gravel.

Yours very truly,

Russell S. Greenman

Sen. Asst. Engineer
in charge of Tests.

STATE OF NEW YORK
DEPARTMENT OF STATE ENGINEER AND SURVEYOR
TESTING LABORATORY
ALBANY

Tests of Sand from .... bank at Johnsonville N. Y.,

for use on Contract ~~No.~~ Repairs to Spillway of Tomhannock ~~Canal~~ Reservoir, Troy, N.Y. ~~Division.~~

Contract Sample No. — taken Aug 18; received at Laboratory Aug 19; made up Aug 19

Sand is composed mainly of grains of sandstone, quartzite, quartz, feldspar and limestone with a little shale and slate.

Percentage of Voids 28.9; Loam 2.9; Organic matter Trace

Parts of sand to cement by ~~weight~~ bulk :— 2 1/2 sand to 1 cement. Per cent water used 11

Temperature of water used in mixing — Fahr. Briquettes kept in moist air 24 hours and then immersed.

Cement used in tests, Standard Blend. This cement tested as follows:—

Sets (determined by Vicat needle):—Initial, {in — min. / Minim. requirement 45 min.} ; hard, {in — min. / Max. requirement 600 min.}

Constancy of Volume Tests:—Normal air —: Normal water —; Accelerated —

Fineness (per cent passing standard sieve No. 100) — (Requirement, 92%)

" (" " " " " No. 200) — (Requirement, 78%)

TENSILE STRENGTH IN POUNDS PER SQUARE INCH						SIZE OF SAND	
STANDARD SAND		NATURAL SAND		WASHED SAND		PASSING SIEVE	
7 Days	28 Days	7 Days	28 Days	7 Days	28 Days	No.	Per Cent
371		435				2	95.8
328		410				4	88.4
367		410				6	83.0
391		400				10	69.0
371		470				20	46.8
1828		2125				30	26.8
366		425				40	10.6
						60	3.4
						74	2.0
						100	1.4
						140	1.2
						200	1.0

Remarks: All of sample over #4, considered as gravel, is composed mainly of small pebbles of sandstone, quartzite and granite with some limestone, shale and slate.

I CERTIFY *that this is a true abstract taken from the records of tests* August 26 1926

Russel S. Greenman

Sr. Ass't Engineer in Charge of Tests

C O P Y

Dam 110, Upper Hudson
Schaghticoke,

Bureau of Water,
Troy,
N. Y.

Gentlemen:

This department acknowledges the receipt of five prints for the reconstruction of the Tomhannock Reservoir dam, fulfilling the first requirement of our letter of August 2nd.

Yours very truly,

Roy G. Finch,
State Engineer.

By

Deputy State Engineer.

ARMcK/ECH

Copy for Mr. McKim

5. That the thickness of the abutments at any point where not braced by the spillway section should be at least equal to 1/2 the vertical depth of the abutment at that point.

6. That the abutments from the new upstream sheet piling cutoff to the core walls and the core walls should be carried to rock or sufficiently deep into the natural bed to prevent any seepage.

This approval shall not be deemed to authorize any invasion of property rights, either public or private, in carrying out the above work; nor to create any claim or demand against the State of New York; nor to authorize the flooding or use of said lands, nor to acquiesce in the flooding or use of such lands.

There is enclosed one set of the above prints stamped with the approval of this department.

Kindly acknowledge the receipt of this letter and of the prints.

Yours very truly,

Roy G. Finch,
State Engineer.

By

Assistant Deputy.

Copy and Print to
Division Engineer R. D. Hendricks.

Copy to G. Sexton Thompson,
257 Broadway,
Troy, N. Y.

3-28-24-1000 (6-4905)

OFFICE STATE ENG.
AUG -9 1926
REF'D TO Return
ANS'D

STATE OF NEW YORK
DEPARTMENT OF
State Engineer and Surveyor
ALBANY

Received .... Dam No. 110 U Hudson Watershed

Disposition Approved Aug 2-1926 Serial No. 709

Foundation inspected ....

Structure inspected ....

Application for the Construction or Reconstruction of a Dam

Application is hereby made to the State Engineer, Albany, N. Y., in compliance with the provisions of Chapter LXV of the Consolidated Laws and Chapter 647, Laws of 1911, Section 22 as amended, for the approval of specifications and detailed drawings, marked ....

....

herewith submitted for the { ~~construction~~ reconstruction } of a dam located as stated below. All provisions of law will be complied with in the erection of the proposed dam. It is intended to complete the work covered by the application about Dec 1/26 (Date)

1. The dam will be on .... flowing into Hoosick River in the town of ...., County of Rensselaer and about 4 miles from Melrose N.Y. (Give exact distance and direction from a well-known bridge, dam, village main cross-roads or mouth of a stream)

2. The name and address of the owner is Water Department, City of Troy N.Y.

3. The dam will be used for Storage of water "

4. Will any part of the dam be built upon or its pond flood any State lands? no

5. The watershed at the proposed dam draining into the pond to be formed thereby is 68 square miles.

6. The proposed dam will have a pond area at the spillcrest elevation of 4.64 Sq. Miles ~~acres~~ and will impound 11,710,000,000 Gals ~~cubic feet~~ of water.

7. The lowest part of the natural shore of the pond is 10 feet vertically above the spillcrest, and everywhere else the shore will be at least 20 feet above the spillcrest.

8. The maximum known flow of the stream at the dam site was .... cubic feet per second on .... (Date)

9. State if any damage to life or to any buildings, roads or other property could be caused by any possible failure of the proposed dam ....

....

10. The natural material of the bed on which the proposed dam will rest is (clay, sand, gravel, boulders, granite, shale, slate, limestone, etc.) See Plans

11. The material of the right bank, in the direction with the current, is ....; at the spillcrest elevation this material has a top slope of ....inches vertical to a foot horizontal on the center line of the dam, a vertical thickness at this elevation of....................feet, and the top surface extends for a vertical height of .... feet above the spillcrest.

12. The material of the left bank is...........................; has a top slope of...............inches to a foot horizontal, a thickness of..................feet, and a height of....................feet.

13. State the character of the bed and the banks in respect to the hardness, perviousness, water bearing, effect of exposure to air and to water, uniformity, etc. ....
....
....

14. If the bed is in layers, are the layers horizontal or inclined?.............................. If inclined what is the direction of the horizontal outcropping relative to the axis of the main dam and the inclination and direction of the layers in a plane perpendicular to the horizontal outcropping..
....

15. What is the thickness of the layers?.......................................

16. Are there any porous seams or fissures?..
....

17. Wastes. The spillway of the above proposed dam will be ......300......feet long in the clear; the waters will be held at the right end by a ......Earth Embankment...... the top of which will be ......11......feet above the spillcrest, and have a top width of......10......feet; and at the left end by a ......Same...... the top of which will be......11......feet above the spillcrest, and have a top width of......10......feet.

18. There will be also for flood discharge a pipe......5 ft...... ~~inches~~ inside diameter and the bottom will be........... feet below the spillcrest, a sluice or gate ....feet wide in the clear by ....feet high, and the bottom will be.................feet below the spillcrest.

19. Apron. Below the proposed dam there will be an apron built of ......Concrete...... feet long across the stream, ...100......feet wide and......12"...... ~~feet~~ thick. The downstream side of the apron will have a thickness of.................. feet for a width of...................feet.

20. Plans. Each application for a permit of a dam over 12 feet in height must be accompanied by a location map and complete working drawings in triplicate of the proposed structure, one set of which will be returned if they are approved. Each drawing should have a title giving the parts shown, the name of the town and county in which the dam site is located, and the name of the owner and of the engineer.

The location map (U. S. Geological Quadrangle or other map) should show the exact location of the proposed dam; of buildings below the dam which might be damaged by any failure of the dam; of roads adjacent to or crossing the stream below the dam, giving the lowest elevation of the roadway above the stream bed and giving the shape,

the height and the width of stream openings; and of any embankments or steep slopes that any flood could pass over. Also indicate the character and use made of the ground below the dam.

The complete working drawings should give all the dimensions necessary for the calculations of the stability of the structure, and all the information asked for below under " Sketches." There may be attached to the application any written reports, calculations, investigations or opinions that may aid in showing the data and method used by the designer. State the assumed ice and uplift pressures and the conditions on which based.

21. SKETCHES. For small and unimportant structures, if plans have not been made, on the back of this application make a sketch to scale for each different cross-section at the highest point; giving the height and the depth from the surface of the foundation, the bottom width, the top width (for a concrete or masonry spill at 18 inches below the crest), the elevation of the top in reference to the spillcrest, the length of the section, and the material of which the section is to be constructed; on the spillway section show a cross section of the apron, giving its width, thickness and material, and show the abutment or wash wall at the end of the spillway, giving its heights and thickness. Mark each section with a capital letter. Also sketch a plan; show the above sections by their top lines, giving the mark and the length of each; the openings by their horizontal dimensions; the abutments by their top width and top lengths from the upstream face of the spillcrest; and outline the apron. Also sketch an elevation of each end of the dam with a cross section of the banks, giving the depth and width excavated into the banks.

22. ELEVATIONS. Also give the elevations, if possible from the Mean Sea Level, of at least two permanent Bench Marks; of the spillcrest for any existing dam on the proposed dam site, at the middle and at the ends of the spill; of the spillcrest for the above proposed dam; and of the spillcrest of any adjacent dams.

23. SAMPLES. When so instructed, send samples of the materials to be used in the construction of the proposed dam. using shipping tags which will be furnished. For sand, one-half a cubic foot is desired (exclusive of any stone over ½ inch in size mixed therewith); for cement, three pints; and for the natural bed, twenty cubic inches if of ledge and one-half a cubic foot if of soil.

24. INSPECTION. State how inspection is to be provided for during construction. Rigid Inspection by a Corps of Engineers.

25. WATER SUPPLY. Are the waters impounded by the above dam to be used for a public water supply? Has an application under the provisions of Article IX of the Conservation Law for such use been made to the Water Control Commission, Albany, N. Y.? Reservoir was built in 1902.

The above information is correct to the best of my knowledge and belief.

G. Saxton Thompson

(Address of signer)

257- Broadway.
Troy. N.Y.

July 31/26

(Date)

Department of Water
City of Troy. N.Y.

G. Saxton Thompson. Consulting Engineer

(A person signing for owner should indicate his title or authority)

Form No. W-91. 10-21-16-500 (16-473)

GEORGE D. PRATT, COMMISSIONER
ALEXANDER MACDONALD, DEPUTY COMMISSIONER
A. S. HOUGHTON, SECRETARY
MARSHALL McLEAN, DEPUTY ATTORNEY-GENERAL

STATE OF NEW YORK

Serial No. ....

DIVISION OF FISH AND GAME — LLEWELLYN LEGGE, CHIEF
DIVISION OF LANDS AND FORESTS — C. R. PETTIS, SUPERINTENDENT
DIVISION OF WATERS — A. H. PERKINS, DIVISION ENGINEER
DIVISION OF SARATOGA SPRINGS — J. G. JONES, SUPERINTENDENT, SARATOGA SPRINGS, N. Y.

CONSERVATION COMMISSION

ALBANY

110 U.H

APPLICATION FOR CONSTRUCTION OR RECONSTRUCTION OF A DAM

Troy, N. Y.
(Address of Applicant)

Application is hereby made to the Conservation Commission of the State of New York, in compliance with the provisions of Chap. LXV of the Consolidated Laws, the Conservation Law, for approval of the detailed specifications and plans, marked Repairing Tomhannock Spillway Dam.

herewith submitted for the { ~~construction~~ reconstruction } of the dam located as stated below. All provisions of law will be complied with in the erection of the said dam, whether specified herein or not.

LOCATION AND GENERAL DATA

Site of dam is on Tomhannock Creek (Name of stream)

a branch of Hoosic River (Name of stream), within the

limits of the town of Schaghticoke & Pittstown, County of Rensselaer

one held mile brom Boston and Maine R. R. and three miles from
(Give approximate distance from well-known bridge, dam, village or mouth of stream, so that work can be located on map of state)
Melrose

Purpose of dam Overflow spillway for the Tomhannock Reservoir

Reasons for making changes in existing structure Leak in dam and washing out of apron

April 17, 1918. (Date)

{ Signature of applicant } Bureau of Water, Troy, N. Y.
J McGiven
Superintendent.

INSTRUCTIONS TO APPLICANTS

Fill out the application in duplicate and send both copies to the Conservation Commission, Albany, N. Y.

Each application must be accompanied by plans of proposed structure in duplicate consisting of—

(1) Location map (U. S. Geological Survey sheet or other map with location of proposed structure indicated thereon).

(2) Map of proposed reservoir showing flow line, buildings, etc.

(3) Complete working drawings or such drawings of plan, sections and elevations as will make clear the dimensions of all parts of the structure, its connection to existing structures, if any, nature of natural foundations, etc., and stress diagrams or other analysis showing the adequacy of the strength of the structure.

(4) Each map and plan shall have a title showing names of owner and engineer, name of county and town in which dam is to be located, and nearest postoffice.

Each application must be accompanied by a report by a competent engineer, substantially as follows:

Adequacy of Spillway:

Give estimate of maximum flood and describe method of estimating.

Give resulting height on spillway crest.

Natural Foundation:

General statement of geology of vicinity as affecting the foundation of the dam.

Description and results of subsurface surveys.

Describe fully materials in natural foundation.

(A) Rock—
- (a) Mineralogy
- (b) Stratification
- (c) Seams and other physical characteristics
- (d) Thickness of strata

(B) Earth—
- (a) Physical composition
- (b) Physical characteristics (Perviousness, hardness, homogeneity, water bearing, effect of exposure to air and water, etc.)

Stability:

Describe type of dam and how destructive forces are met.

Give methods of computation and results as to—
- (a) Overturning
- (b) Sliding
- (c) Under-seepage
- (d) Undermining (sufficiency of apron and wash wall)
- (e) Sloughing of earth embankments
- (f) Overtopping of earth embankments

(Above should be given for each part of dam having different section.)

Inspection:

State how inspection of work is to be provided for during construction.

Send sample of sand and of each lot of cement to State Testing Laboratories, Albany, N. Y., using shipping tags which will be furnished you.

FILE

April 23, 1918.

Mr. J. W. Diven,
Supt. of Water Works,
T r o y, N. Y.

Dear Sir:-

Our Inspector of Docks & Dams visited your 110 VH Tomhannock Reservoir and your 21 VH Vanderheyden Reservoir on the 11th of April. He reports that the work which you have done on these dams is simply repair work. The approval of this Commission would not, under these conditions, be required.

Yours very truly,

GEORGE D. PRATT, Commissioner,

By,

DIVISION ENGINEER.

AHP/F

April 22, 1918.

In re Dam #110 Upper Hudson at
Schaghticoke, known as the
Tomhannock Reservoir at Troy.

Mr. A. H. Perkins, Division Engineer,

Conservation Commission,

P R E S E N T:

Dear Sir:-

I inspected this dam on April 11th and found the bed was of blue clay with a well cemented gravel under. The dam has been repaired by cutting out the layer of laitance, the apron has also been repaired and put in good condition. The work has already been done, and I should consider this but repair work.

Respectfully submitted,

Inspector of Docks and Dams.

McK/C.

April 12, 1918.

Mr. J. W. Diven,
Superintendent,
Water Works,
Troy, New York.

Dear Sir:-

In re. Tomhannock reservoir (#110 Upper Hudson) at Schaghticoke:

We wrote you on February 21, 1917 enclosing an application blank for the reconstruction of the dam of this reservoir. Inspector McKim reported that you would submit plans shortly but we have heard nothing from you, and we find that the dam has been completed. Will you kindly advise us as soon as possible in regard to this matter?

Yours very truly,

GEORGE D. PRATT, COMMISSIONER.

By ____________________________

DIVISION ENGINEER.

MCK:MR.

February 21, 1917.

Mr. J. W. Diven, Superintendent

of Water Works,

Troy, N. Y.

Dear Sir:-

Enclosed find application blanks to be filled out and submitted to this Commission for approval for the reconstruction of the Tomhannock reservoir.

Very truly yours,

GEO. D. PRATT, Commissioner,

By

Division Engineer.

McK/C.

Encl.

FEB 4 1917

[illegible] TO DAM

[illegible] MEASURE PASS[illegible] [illegible] BOARD.

[illegible] Tomhan[illegible] [illegible] Which Might Have [illegible] Property Damage [illegible] of Life.

[illegible] meeting of the board of [illegible] and supply yesterday Superin[illegible] Diven of the water depart[illegible] announced that a leak in the [illegible] dam at the Tomhannock [illegible] had to be repaired at once, [illegible] was given the necessary per[illegible] to work in conjunction with [illegible] of Public Works Crow[illegible] and have the damage repaired at [illegible]. It was shown that if imme[illegible] action was not taken great da[illegible] might be done property and the[illegible] be loss of lives. The repa[illegible] cost between $50,000 and $60,[illegible]

[illegible] was a week ago Friday that [illegible] was discovered, said Supe[illegible] Diven. He was called to [illegible]hannock reservoir, where it [illegible] that a hole existed in the [illegible] seven feet below the top [illegible] getting worse. [illegible] advisable to have ex[illegible] and [illegible] the situation [illegible] William R. Hills, who [illegible] charge of the construction of [illegible] dam, and Fred P. Stearns of [illegible] experts in [illegible]struction, were summoned here [illegible] they decided that repairs had to [illegible] immediately. If the work [illegible] done before spring it would [illegible]ard to forecast the damage that [illegible] be done. Mr. Diven said that [illegible] had opened the mud gates of the [illegible]ervoir, thus relieving the situation [illegible] lowering the water and reducing [illegible] pressure.

[illegible]uperintendent Diven said the rea[illegible] for the break was that the con[illegible] placed in the dam was not of [illegible]cient strength, and furthermore [illegible] dam was built on loose soil.

Mayor Burns took occasion to con[illegible] the water system as it existed [illegible] he took office. He said the de[illegible]ment had been a great thorn in [illegible] side, and the present administra[illegible] had already expended about [illegible],000 on improvements and re[illegible] to a system that was built only [illegible] short time ago. He said it was a [illegible]lorable condition of affairs, and [illegible] not think there was justice in [illegible] one administration stand the [illegible] of it all.

"We have practically reconstructed [illegible] entire waterworks system of the [illegible]," said the mayor, "and it is [illegible] to take the heart out of any [illegible]. The legacies from previous [illegible]istrations have been coming to [illegible] and fast."

"[illegible] will have a good system wh[illegible] [illegible] made," said Superin[illegible]

[illegible] think we should [illegible] mayor. "The [illegible] business [illegible] large debts [illegible] be borne by one [illegible]

Crowley stated to-day that the wo
of repairs, or as it might be terme
partial reconstruction of the Tom
hannock reservoir spillway da
which sprung a dangerous leak
month ago and threatened seriou
harm for the Tomhannock valley, in
cluding the washing away of bridg
and the flattening of railroad balla
beds, was progressing satisfactori
and it was believed that all dang
was now past.

By taking prompt action th
authorities state that they saved wh
undoubtedly would have proved to
a large expense to the city.

A Bad Break.

It will be remembered that Sup
intendent of Water Works Diven r
ported at a meeting of the board
contract and supply that there wa
bad break in the dam and that th
was danger that the whole sup
structure might be so weakened th
it could easily be carried away shou
the spring floods attack it. Not on
was there a fissure about nine fe
below the crest of the dam, but wat
was spurting up from interstices
the pavement.

An Emergency Order.

After the superintendent had su
mitted his report, Commissione
Crowley secured the adoption of
emergency order for immediate r
pairs and the sum of $60,000 w
fixed as the probable cost.

The city was fortunate to a gre
degree in securing aid in this matte
The ordinary local contractor cou
not possibly take up the work in
moment of mending the ribs and th
anatomy generally of a giant of
dam which holds back millions
gallons of water and so it was w
relief that the authorities found th
Great Lakes Construction compa
which is doing work in this vicini
ready to take on the job. And Co
missioner Crowley says they are goi
to work in a manner that would
dicate that the dam will be place
a safe condition.

A Steel Fence.

A steel and iron fence—for that
what it really means to the layma
and a sort of coffer-dam to the
itiated—will be placed just beyo
the concrete work of the dam to h
back the pressure of the water, a
then repairs will be made to the co
crete itself and an investigation m
of the "floor" of the dam to see
just what foundation it rests.

It will be remembered that at t
time of the report of the leak th
noted experts who had been engag
by the city to make an investigati
said that the dam had not been w
placed—to this extent that the
soil or rock bottom strata was n
satisfactory and was not ancho
sufficiently to sustain the wall of
dam which was holding back
great quantity of water..

This iron and steel sheathing
be sunk into the ground and wi
made permanent to the end that t
will ever be a shield between the
itself and the water.

As a preliminary to this wo
setting the iron curtain
[illegible]

[illegible] WORK

[illegible] for the [illegible] All Danger is Past [illegible] That the Methods Employed to [illegible] the Tomhannock Dam [illegible] Permanent Results.

[illegible] of Public Works [illegible] to-day that the work [illegible] might be termed, [illegible] of the Tom- [illegible] spillway dam [illegible] a dangerous leak a [illegible] ago and threatened serious [illegible] for the Tomhannock valley, in- [illegible] the washing away of bridges [illegible] of railroad ballast [illegible] was progressing satisfactorily [illegible] it was believed that all danger [illegible] now past.

[illegible] taking prompt action the [illegible] state that they saved what [illegible] would have proved to be [illegible] to the city.

[illegible] Bad Break.

[illegible] be remembered that Super- [illegible] of Water Works Diven re- [illegible] at a meeting of the board o[illegible] [illegible] in the dam and that ther[illegible] [illegible] that the whole super- [illegible] might be so weakened tha[illegible] [illegible] easily be carried away shoul[illegible] [illegible] spring floods attack it. Not onl[illegible] [illegible] there a fissure about nine fee[illegible] [illegible] the crest of the dam, but wat[illegible] [illegible] spurting up from interstices i[illegible] [illegible] pavement.

An Emergency Order.

After the superintendent had sub- [illegible] his report, Commissioner [illegible] secured the adoption of a[illegible] [illegible] order for immediate re- [illegible] and the sum of $60,000 wa[illegible] [illegible] as the probable cost.

The city was fortunate to a grea[illegible] [illegible] in securing aid in this matter [illegible] ordinary local contractor could [illegible] possibly take up the work in [illegible] [illegible] of mending the ribs and the [illegible] generally of a giant of [illegible] [illegible] which holds back millions of [illegible] of water and so it was with [illegible] that the authorities found the [illegible] Lakes Construction company, [illegible] [illegible]

A [illegible]

[illegible]

$60,000 TO REPAIR SPILLWAY BREAK

SUPT. DIVEN NOTIFIES BOARD OF CONTRACT AND SUPPLY

WILL REPAIR IT AT ONCE

There is a large crack in the first of the two spillway dams at the city's waterworks system and unless immediate steps are taken to make repairs and restore the spillway to a safe condition Superintendent of Waterworks Diven and Commissioner of Public Works Crowley stated Saturday at a meeting of the board of contract and supply that the most serious consequences must result in the spring-time when the annual floods come. It was thought that with a thorough overhauling all real danger for the present would be done away with which would jeopardize property and even lives due to a breaking away of the spillway which would surely carry before it the second spillway and a torrent would be released to flow down hill and mountainside.

Needing Immediate Attention.

Two of the best known experts in dam construction in the United States were called in by the city and they report the condition as serious and needing immediate attention. According to both Commissioner Crowley and Superintendent Diven the fault is laid to the door of improper construction—namely that the concrete was not strong enough and the character of the soil too light to stand up under a dam against which billions of gallons of water were pressing.

Mayor Burns, who presided at the meeting of the board, explained that all this work was done by a former administration and since he had come into the responsibility of running the city's business he had been forced to expend about $825,000 to make this waterworks' system what it should be, and the end was not in sight evidently, as it was calculated that the work of repairs alone would cost from $50,000 to $60,000.

Over Eleven Billion Gallons.

The Tomhannock reservoir is 390 feet above the level of the city and impounds eleven billion, seven hundred million gallons of water. This water is the source of supply of the main part of the city, with the exception of that section in what might readily be termed that of the Hope farmer in Albia.

The direct danger from flood in one of these spillways breaking down and permitting this great lake to rush ahead would be to the Tomhannock valley, as the Tomhannock into which the spillways empty in turn flow into the Hoosick river near Schaghticoke. The danger to the city of Troy should the reservoirs empty itself in ordinary fashion would be a lack of water for the usual purposes—in ... mean a famine—and then the [illegible] ... the present as well as the [illegible] ... to [illegible] ... water is running into the city.

No Present Real Danger.

Superintendent Diven said that it was both his opinion and that of Commissioner of Public Works Crowley and the two experts that at present there was no real danger, but that the spring floods would surely create a condition that the city could in no way afford to stand. Therefore it was decided to get to work and make the necessary repairs.

Mayor Burns said that it was a matter for great regret by the administration that this had happened as it for one thing was in line with what had occurred in other ways of finance before which his administration had to stand for. He said the present system was under construction from 1903 to 1905 and that his administration had had to stand the cost of putting it in shape to meet the demands of the city service after it had been turned over.

Amount Escaping Daily.

Superintendent Diven said that at the present time—of course all possible having been done by him to render what might be termed first aid to such a situation—between two and three million gallons of water are escaping daily.

Superintendent Diven said after Mayor Burns recounted what had been done by him to place the system in a satisfactory condition that when all was done that Troy would certainly have a plentiful supply of fine water.

Mayor Burns said, "Yes, that is so, but we have had to accept all these legacies and to pay for them. It is evidence that municipalities in this country should be awake to the advisability of appointing business managers for their affairs so that one incoming administration will not inherit a lot of mistakes made by the outgoing one."

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The direct danger from flood in case of these spillways breaking down and permitting this great lake to rush ahead would be to the Tomhannock valley, as the Tomhannock into which the spillways empty in turn flow into the Hoosick river near Schaghticoke.

The danger to the city of Troy should the reservoirs empty itself in summary fashion would be a lack of water for the usual purposes—in some ways a famine—and then the danger from fire due to insufficient pressure in the mains.

It will be recalled that this same spillway or rather the one on the same spot gave way in 1906 and a large amount of damage was done to property in the valley. Bridges were partly carried away and railroad tracks washed out.

Discovered a Week Ago.

Superintendent Diven told the members of the board that the leak was discovered a week ago and on investigation he found that there was a crack in the first dam about seven feet below the crest. Water was spurting out, not dribbling out, showing that it was evident that the work had given away on the dam side and that the water had gradually forced its way inside until the pressure was enough to crack the concrete facing and make a cascade.

He said the danger was imminent unless immediate steps were taken to get a contractor at work and make the necessary repairs. Superintendent Diven said that he had made a report of the matter and had engaged the services of two of the best known experts in the United States, William R. Hill, the engineer on the new Croton dam for New York city and F. P. Stearns of Boston.

These men made a thorough investigation and reported that immediate repairs of the most substantial nature were necessary. Mr. Diven said these men had found that the concrete in the construction work was [illegible] [illegible]

water.

Mayor Burns said, "Yes, that is so, but we have had to accept all these legacies and to pay for them. It is evidence that municipalities in this country should be awake to the advisability of appointing business managers for their affairs so that one incoming administration will not inherit a lot of mistakes made by the outgoing one."

Break in Spillway Dam to Cost City $50,000 or $60,000

Report of Water Works Superintendent Made to the Board of Contract and Supply To-day—To Proceed at Once With Repairs—Large Amount of Water Escaping Daily for a Week Past—Situation Serious.

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There is a large crack in the first of the two spillway dams at the city's waterworks system and unless immediate steps are taken to make repairs and restore the spillway to a safe condition Superintendent of Waterworks Diven and Commissioner of Public Works Crowley stated this noon at a meeting of the board of contract and supply that the most serious consequences must result in the spring-time when the annual floods come. It was thought that with a thorough overhauling all actual danger for the present would be done away with which would jeopardize property and even lives due to a breaking away of the spillway which would surely carry before it the second spillway and a torrent would be released to flow down hill and mountainside.

Needing Immediate Attention.

Two of the best known experts in dam construction in the United States were called in by the city and they report the condition as serious and needing immediate attention. According to both Commissioner Crowley and Superintendent Diven the fault is laid to the door of improper construction—namely that the concrete was not strong enough and the character of the soil to light to stand up under a dam against which billions of gallons of water were pressing.

Mayor Burns, who presided at the meeting of the board, explained that all this work was done by a former administration and since he had come into the responsibility of running the city's business, he had been forced to expend about $825,000 to make the waterworks' system what it should be, and the end was not in sight evidently, as it was calculated that the work of repairs alone would cost from $50,000 to $60,000.

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The danger to the city of Troy should the reservoirs empty itself in summary fashion would be a lack of water for the usual purposes—in some ways a famine—and then the danger from fire due to insufficient pressure in the mains.

It will be recalled that this same spillway or rather the one on the same spot gave way in 1906 and a large amount of damage was done to property in the valley. Bridges were partly carried away and railroad tracks washed out.

Discovered a Week Ago.

Superintendent Diven told the members of the board that the leak was discovered a week ago and on investigation he found that there was a crack in the first dam about seven feet below the crest. Water was spurting out, not dribbling out, showing that it was evident that the works had given awoy on the dam side and that the water had gradually forced a way inside until the pressure was enough to crack the concrete facing and make a cascade.

He said the danger was imminent unless immediate steps were taken to put a contractor at work and make the necessary repairs. Superintendent Diven said that he had made a report of the matter and had engaged the services of two of theb est known experts in the United States, William B. Hills, the engineer on the new Croton dam for New York city and F. P. Stearns of Boston.

These men made a thorough investigation and reported that immediate repairs of the most substantial nature were necessary. Mr. Diven said these men had found that the concrete used in the construction work was too light and also that [illegible] the spillways are built is of too light a character.

Between the two spillways is a pavement of concrete. It is believed that the water is both going through the work of the first spillway and also going under it, as this pavement is forced up in spots and water is spurting into the air.

No Present Real Danger.

Superintendent Diven said that it was both his opinion and that of Commisisoner of Public Works Crowley and the two experts that at present there was no real danger, but that the spring floods would surely create a condition that the city could in no way afford to stand. Therefore it was decided to get to work and make the necessary repairs.

Mayor Burns said that it was a matter for great regret by the administration that this had happened as for one thing was in line with what had occurred in other ways of finance before which hi sadministration had to stand for. He said the present system was under construction from 1903 to 1905 and that his administration had had to stand the cost of placing it in shape to meet the demands of the city service after it had been turned over.

Amount Escaping Daily.

Superintendent Diven said that at the present time—of course all possible having been done by him to order what might be termed first aid to such a situation—between two and three million gallons of water are escaping daily.

Superintendent Diven said after Mayor Burns recounted what had been done by him to place the system in a satisfactory condition that when all was done that Troy would certainly have aplentiful supply of fine water.

Mayor Burns said, "Yes, that is so, but we have had to accept all these blunders and to pay for them. It is evidence that municipalities in this country should be awake to the advisability of appointing business managers for their affairs so that one incoming administration will not inherit a lot of mistakes made by the outgoing

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July 21, 1917.

Mr. J. W. Diven,

Superintendent, Water Works,

Troy, N. Y.

Dear Sir:-

Inspector McKim visited the Tomhannock reservoir on July 17.

As soon as the condition is ascertained and the plans are ready for the reconstruction, send us a set of prints and the completed application blank which we mailed you on February 21.

Yours very truly,

GEORGE D. PRATT, COMMISSIONER,

By ___________________________

DIVISION ENGINEER.

McK;MH.

WEEKLY REPORT. July 21, 1917.

Mr. A. H. Perkins, Division Engineer,
Conservation Commission,
P R E S E N T.

Dear Sir:-

The following is report of work done by me during the week ending July 22, 1917:-

July 17 -- Inspected Tomhannock reservoir of the city of Troy. The row of steel sheet piling had been driven up stream from the spillway and men were at work cutting away the back part of the spillway in order to determine how deep the water had seeped through. There was a crack 2 feet 6 inches from the top of the laitance which is very soft and contains considerable dirt. The failure of the dam was probably due to this laitance.

Inspected dam #2 Mohawk at Waterford to corroborate report of Assistant Prudhon. I found conditions fair and probably no harm would be done if dam went out.

Inspected dam #15 Mohawk at Cohoes and found the work finished and in operation. The condition is very good.

Inspected dam #224 Mohawk at Mariaville and found it in the same condition, no work having been done since my last inspection.

July 18 -- Inspected dam #389 Mohawk at East Windham. Found the work finished and apparently in good condition.

Inspected dam #418 Mohawk at Windham to corroborate report of Assistant Hyde. The dam is in poor condition but no harm would be done if it went out. The dam will probably be rebuilt but not this year.

Week ending 7/22/17.

July 19 -- Inspected dam #448-a at Richmondville. The dam was finished and the concrete good, on a limestone ledge bed. Maximum height of the dam was 8 feet instead of 5 feet as per plans. It is a thin dam 21 inches on top, 3 feet thick and 8 feet down.

Inspected dam #410 Mohawk at Cobleskill. No work has been done on the reconstruction and it probably will not be rebuilt. [illegible]

Inspected dam #407 Mohawk at Cobleskill and found that the thin retaining wall had been braced by timber. The work has not been particularly well done but there is little danger in connection therewith.

Visited Mrs. Daniel J. Vrooman of Schoharie concerning the reported construction of a dam at Schoharie. It is not proposed to construct the dam at this time.

July 20 -- Inspected dam #298 Mohawk between the towns of Charleston and Florida, Montgomery County. Nothing has been done towards the reconstruction of this dam. [illegible]

Inspected vicinity of the site for dam #427 Mohawk of the city of Johnstown. The soil here is loamy earth with some bolders, mostly granite, from a glacial formation, but I found no outcropping of any ledge rock, and the excavations will have to be carefully watched to see if there is any such.

Inspected dam #446 Mohawk at Rockwood. I found the gates open and no water impounded. The dam proper and the apron were apparently finished. No work has yet been done on the curtain cut-off.

Next week I propose to continue my work inspecting the left side of the Lower Hudson.

Respectfully yours,

INSPECTOR OF DOCKS AND DAMS.

McK:MH.

[illegible] N. Y. TIMES (1[illegible])

[illegible]turday, February 3, 1917.

[D]AM IN DANGER.

[illegible] Discovered in Spillway at Tom[hannock] Reservoir—Conference [illegible] [E]xperts Decides That Immediate [Re]pairs Are Imperative—[illegible]

[T]he spillway dam at the Tomhannock [res]ervoir needs immediate improvement [illegible] between \$[illegible],000 [illegible] according to a statement made [illegible] [by] Superintendent [illegible] of the Water [illegible] the Members of [the] [Board] of [illegible] and Supply. He [illegible] [illegible] [illegible] danger [illegible] property.

[Danger] of [Dam] Breaking.

[In] [explaining] the situation Superin[tendent] [Diven] stated that a week ago [illegible] summoned to the [Tom]hannock reservoir, where he was in[formed] [that] [a] [leak] had occurred. When he [arr]ived there he found it at the spill[w]ay dam, [illegible] feet below the top [of] the dam. It was growing worse, and [in] a short time it was found that the [le]ak had [illegible] in some earth giving [w]ay under the [illegible] dam of the [res]ervoir. The danger of the breaking [of] the dam was at once apparent, and [if] such a thing happened it would have [c]arried away undoubtedly about 2,[illegible],[illegible] gallons of water. This would [illegible] everything ahead of it probably, [and] it was easy to see the damage that [wo]uld be caused.

Experts Called In.

[S]uperintendent Diven said that he [sa]w immediate action was necessary [an]d summoned William R. Hill, who [ha]d charge of the work on the Croton [D]am, and after consultation with him [de]cided to call in another expert, Fred [P.] Stearns of Boston, Mass., one of the [bes]t authorities on dam construction in the United States. The three men con[f]erred for a time, and it was the unani[m]ous opinion that something must be [do]ne at once. Mr. Diven said that the [dam] is unsafe, and if repairs were not [ma]de before the spring freshet he feared [the] worst. In order that danger at [illegible] might be reduced to a minimum [he] had the [illegible] gates opened, so that [the] pressure would be greatly reduced, [and] the water in the reservoir lowered [illegible]. There is yet one leak, trace [illegible] has not been obtained.

[illegible] Reasons Given.

[In] answer to Corporation Counsel Guy, [Mr]. Diven said the Tomhannock reser[v]oir was constructed between 1[illegible] and [illegible]. He ascribed as a reason for the newly discovered leak the fact that the [illegible] were weak and the dam

Tomhannock reservoir, where he was informed a leak had occurred. When he arrived there he found it at the spillway dam, about seven feet below the top of the dam. It was growing worse, and in a short time it was found that the leak had resulted in some earth giving away under the second dam of the reservoir. The danger of the breaking of the dam was at once apparent, and if such a thing happened it would have carried away undoubtedly about 3,500,000,000 gallons of water. This would take everything ahead of it probably, and it was easy to see the damage that would be caused.

Experts Called In.

Superintendent Diven said that he saw immediate action was necessary and summoned William R. Hill, who had charge of the work on the Croton dam, and after consultation with him decided to call in another expert, Fred P. Stearns of Boston, Mass., one of the best authorities on dam construction in the United States. The three men conferred for a time, and it was the unanimous opinion that something must be done at once. Mr. Diven said that the dam is unsafe, and if repairs were not made before the spring freshet he feared the worst. In order that danger at present might be reduced to a minimum he had the mud gates opened, so that the pressure would be greatly reduced, and the water in the reservoirs lowered [illegible] week. There is yet one leak, trace of which has not been obtained.

The Reasons Given.

In answer to Corporation Counsel G[illegible], Mr. Diven said the Tomhannock reservoir was constructed between 1908 and 19[illegible]. He ascribed as a reason for the newly discovered leak the fact that the concrete was very weak, and the dam had been built on loose soil. He said that the Commissioner of Public Works should be authorized to put the dam in proper shape, and the necessary permission was given by the Board, it being agreed that work would be started this [illegible] and rushed to completion.

"If this work is started immediately," said Superintendent Diven, "the people of the city need have no fear of the spring freshets, for the dam will be made as solid as is possible."

Mayor Burns's Statement.

Mayor Burns took occasion to condemn the water system as it existed when he took office. He said the department had been a great thorn in his side and the present administration had already expended about $[illegible] on improvements and repairs to a system that was built only a short time ago. [illegible] was a deplorable condition of [illegible], and did not think there was [illegible] having one administration [illegible] of it all.

[illegible] have practically [illegible] system of the [illegible] the Mayor, "and it [illegible] [illegible]

[illegible]

Troy Times

FEB - 3 1917

DAM IN DANGER.

[illegible] Discovered in Spillway at Tomhannock Reservoir—Conference of Experts Decides That Immediate Repairs Are Imperative—The Estimated [illegible]

[illegible] spillway dam at the Tomhannock [illegible] immediate improvements [illegible] between [illegible] and [illegible] to a statement made [illegible] Superintendent Diven of the [illegible] partment to the members [illegible] of Contract and Supply. [illegible] Commissioner of Public Works [illegible] empowered to go ahead and [illegible] necessary improvements, for [illegible] and [illegible] if action was not [illegible] result in danger [illegible] of citizens and their property.

Danger of Dam Breaking.

[illegible] explaining the situation Superintendent Diven stated that a week [illegible] day he was summoned [illegible] Tomhannock reservoir, where [illegible] a leak had occurred [illegible] there he found it [illegible] dam, about seven feet below [illegible] the dam. It was growing worse, [illegible] short time it was found that the [illegible] had resulted in some earth giving way under the second dam at the reservoir. The danger of the breaking of the dam was at once apparent, and [illegible] such a thing happened it would have carried away undoubtedly about [illegible] gallons of water. This would [illegible] everything ahead of it probably, [illegible] it was easy to see the damage that would be caused.

Experts Called In.

Superintendent Diven said that he [illegible] immediate action was necessary [illegible] summoned William R. Hill, who [illegible] charge of the work on the Croton [illegible], and after consultation with him [illegible] decided to call in another expert, Fred [illegible] Stearns of Boston, Mass., one of the [illegible] authorities on dam construction in the United States. The three men conferred for a time, and it was the unanimous opinion that something must be done at once. Mr. Diven said that the dam is unsafe, and if repairs were not made before the spring freshet he feared the worst. In order that danger at present might be reduced to a minimum [illegible] had the mud gates opened, so that the pressure would be greatly reduced, and the water in the reservoirs lowered very much. There is yet one leak, trace of which has not been obtained.

[illegible] Common Council [illegible] Tomhannock [illegible] between 1900 and [illegible] a reason for the [illegible] the fact that [illegible] He said [illegible] the [illegible] necessary [illegible] it [illegible] started [illegible] to completion. [illegible] immediately [illegible] Diven, "the [illegible] of the [illegible] the dam will [illegible]"

[illegible]

Mayor [illegible] took occasion to [illegible] the water system as it [illegible] He said the [illegible] had been a [illegible] in the side, [illegible] the present administration had [illegible] about [illegible] on [illegible] to a system that [illegible] short time ago. He [illegible] deplorable condition of affairs, [illegible] think there was justice in having this administration stand the [illegible] of it all.

"We have practically reconstructed the [illegible] waterworks system of the city," said the Mayor, "and it is enough to take the heart out of any person. The legacies from previous administrations have been coming to us thick and fast."

"We will have a good system when these repairs are made," said Superintendent Diven.

"Well, I should think we should have," replied the Mayor. "The great trouble here is that a business manager is needed, so that large debts like this will not be [illegible] by one administration."

Troy Budget

FEB 11 1917

[illegible] WATER WORKS [illegible]

[illegible]

"Under [illegible] the [illegible] repairs must be [illegible] would precipitate a [illegible] through the [illegible] the Tomhannock has [illegible] moreover, it would [illegible] the greater part of [illegible]

When [illegible] with it is hoped [illegible] call for no further [illegible]. They will [illegible] of an example [illegible] giving the [illegible] thorough [illegible]


SARATOGA AND CHAMPLAIN DIV.
HUDSON
DELAWARE AND HUDSON R.R.
CHAMPLAIN CANAL


Newtonville

3. 328	2738 = w
1. 243	0380 } z^2
1. 243	0380 } 17.5
1. 079	1612 12"
7. 093	5310 = H"

7.973 5310
5.3644152
1.7271190

4 - 1/4 e

Form IW51. 11-6-14-1000 (16-1038) Acc. 985

(NOTICE: After filling out one of these forms as completely as possible for each dam in your district, return it at once to the Conservation Commission, Albany.)

STATE OF NEW YORK

CONSERVATION COMMISSION

ALBANY

225 大

110 UH

DAM REPORT

June 20, 1916
(Date)

CONSERVATION COMMISSION,

67

DIVISION OF INLAND WATERS.

GENTLEMEN:

I have the honor to make the following report in relation to the structure known as the Tomhannock (Main) Dam.

This dam is situated upon the Tomhannock Creek (Give name of stream) in the Town of Pittstown, Rensselaer County, about ½ mile (State distance) from the Village ~~or City~~ of Schaghticoke

The distance up (Up or down) stream from the dam, to the Raymertown dike (Give name of nearest important stream or of a bridge), is about 3¾ miles (State distance)

The dam is now owned by City of Troy (Give name and address in full)

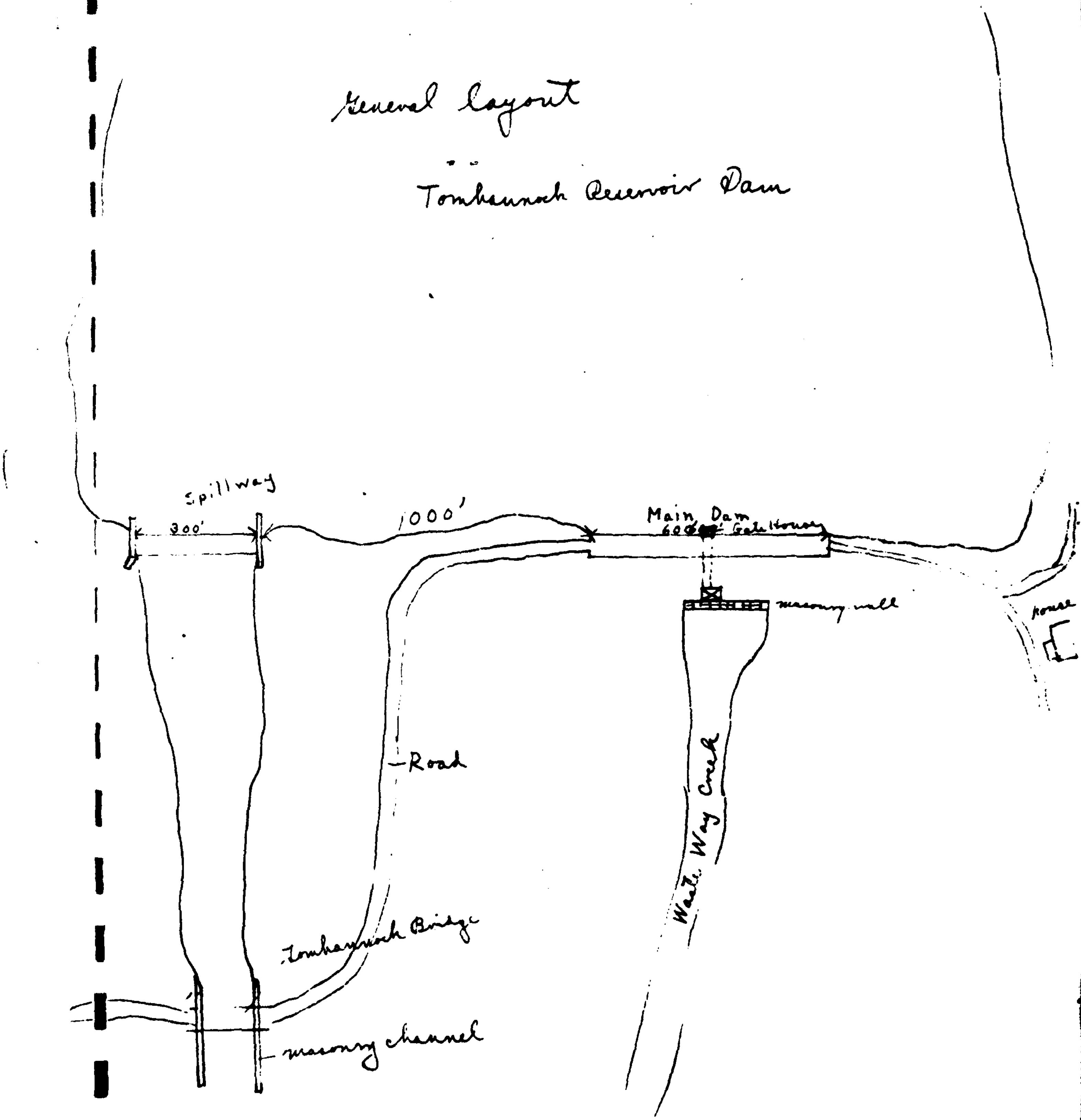
and was built in or about the year 1903, and was extensively repaired or reconstructed during the year

As it now stands, the spillway portion of this dam is built of concrete (State whether of masonry, concrete or timber)

and the other portions are built of earth embankment, concrete core (State whether of masonry, concrete, earth or timber with or without rock fill)

As nearly as I can learn, the character of the foundation bed under the spillway portion of the dam is rock and clay and under the remaining portions such foundation bed is rock and clay

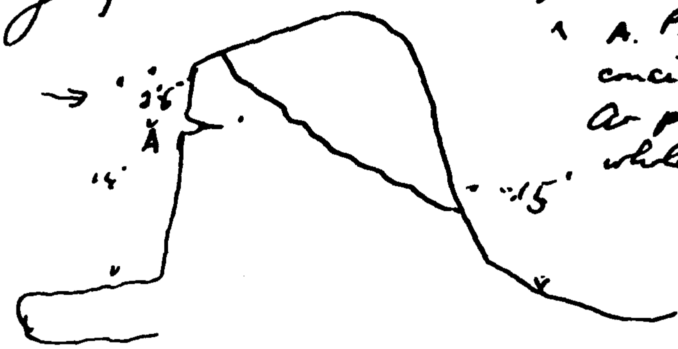
(In the space below, make a third sketch showing the general plan of the dam, and its approximate position in relation to buildings or other conspicuous objects in the vicinity.)



(In the space below, make one sketch showing the form and dimensions of a cross section through the spillway or waste-weir of this dam, and a second sketch showing the same information for a cross section through the other portion of the dam. Show particularly the greatest height of the dam above the stream bed, its thickness at the top, and thickness at the bottom, as nearly as you can learn.)

60225 Ky.

July 1717. Steel sheet piling has been driven upstream from spillway.



A. Probably limestone, very soft and contains considerable dirt at present at out side at least. Are present digging out cracks to see if whole dam was undermined. A R McKee

April 11-18. Water level 1/2" over spill. Repair work finished. Apron filled in even with concrete floor. Spillway repaired. A R McKee

The total length of this dam is 600 feet. The spillway or waste-weir portion, is about 300' feet long, and the crest of the spillway is about 10 feet below the top of the dam.

The number, size and location of discharge pipes, waste pipes or gates which may be used for drawing off the water from behind the dam, are as follows: 5' steel riveted sy thru dam opening by 3 sluice gates $1\frac{1}{2}' \times 4\frac{1}{2}'$

At the time of this inspection the water level above the dam was ft. 2 in. below ~~above~~ the crest of the spillway.

(State briefly, in the space below, whether, in your judgment, this dam is in good condition, or bad condition, describing particularly any leaks or cracks which you may have observed.)

Dam in excellent condition

Reported by Charles A C... (Signature)

... Stadium C...
(Address—Street and number, P. O. Box or R. F. D. route)

Syracuse N.Y.
(Name of place)

Form IW 31. 11-6-14-1000 (16-1038) Acc. 38a

(NOTICE: After filling out one of these forms as completely as possible for each dam in your district, return it at once to the Conservation Commission, Albany.)

STATE OF NEW YORK

CONSERVATION COMMISSION

ALBANY

225-7

110 OH

DAM REPORT

June 20 6/18, 1916
(Date)

CONSERVATION COMMISSION,

DIVISION OF INLAND WATERS.

GENTLEMEN:

I have the honor to make the following report in relation to the structure known as the Tomhannock Reservoir Dam.

This dam is situated upon the Tomhannock Creek (Give name of stream)

in the Town of Pittstown, Rensselaer County,

about 1/2 mile (State distance) from the Village ~~or City~~ of ~~Raymertown~~ Schaghticoke

The distance up (Up or down) stream from the dam, to the Raymertown dike (Give name of nearest important stream or of a bridge)

is about 3 3/4 miles (State distance).

The dam is now owned by City of Troy (Give name and address in full)

and was built in or about the year 1903, and was extensively repaired or reconstructed during the year ....

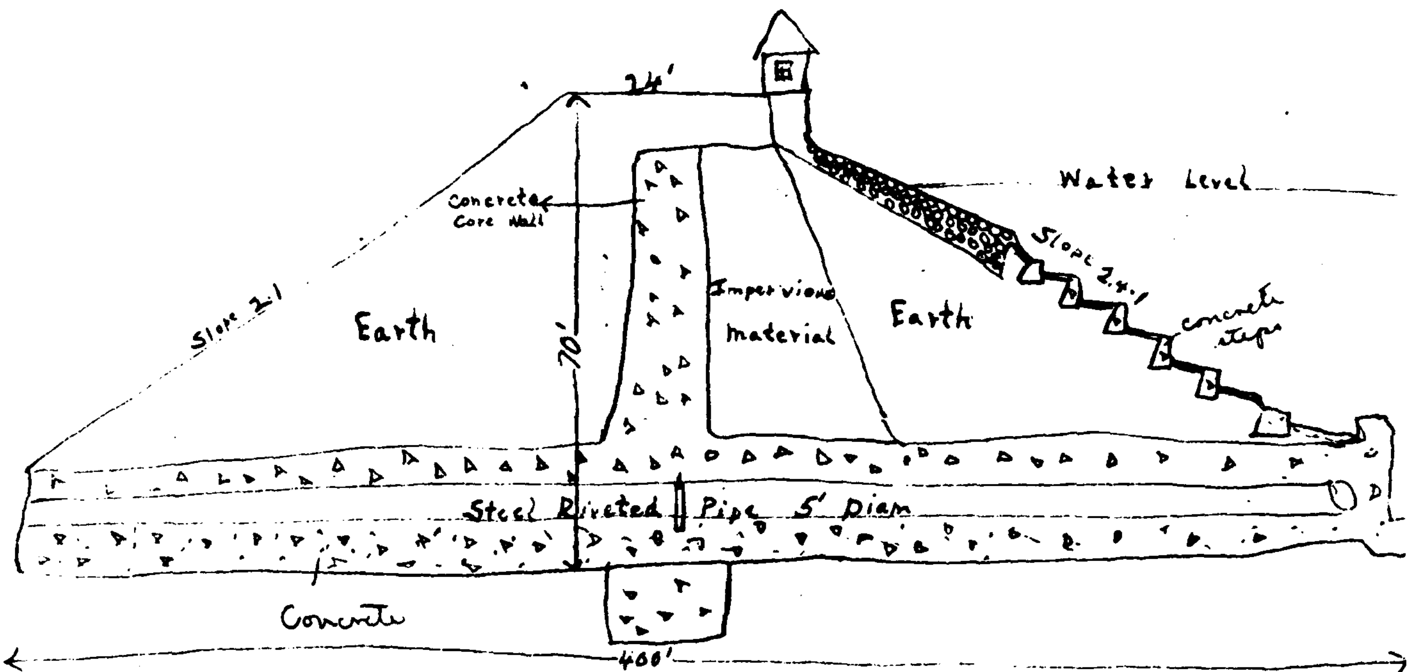
As it now stands, the spillway portion of this dam is built of concrete (State whether of masonry, concrete or timber)

and the other portions are built of earth filled, concrete core (State whether of masonry, concrete, earth or timber with or without rock fill)

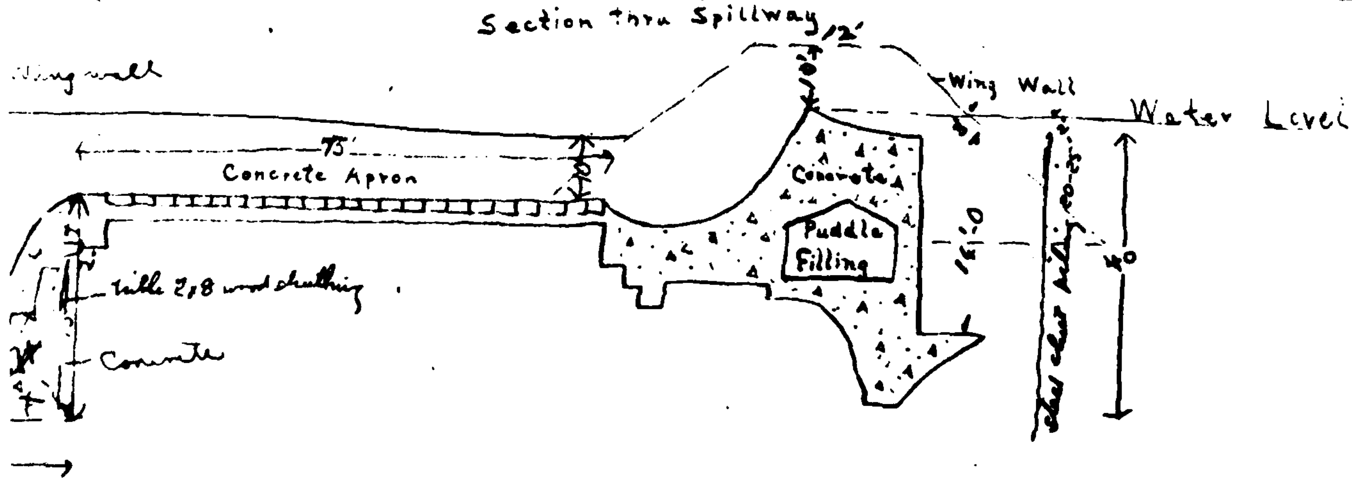
As nearly as I can learn, the character of the foundation bed under the spillway portion of the dam is rock and clay and under the remaining portions such foundation bed is rock and clay.

(In the space below, make *one* sketch showing the form and dimensions of a cross section through the spillway or waste-weir of this dam, and a second sketch showing the same information for a cross section through the other portion of the dam. Show particularly the greatest height of the dam above the stream bed, its thickness at the top, and thickness at the bottom, as nearly as you can learn.)

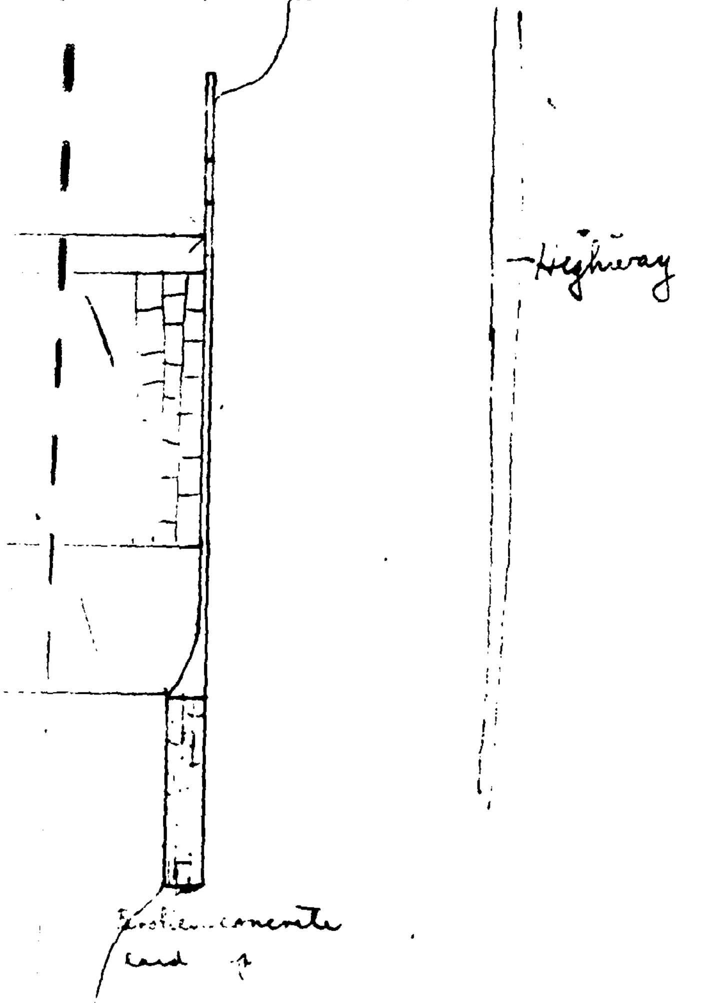
Section Thru Main Dam



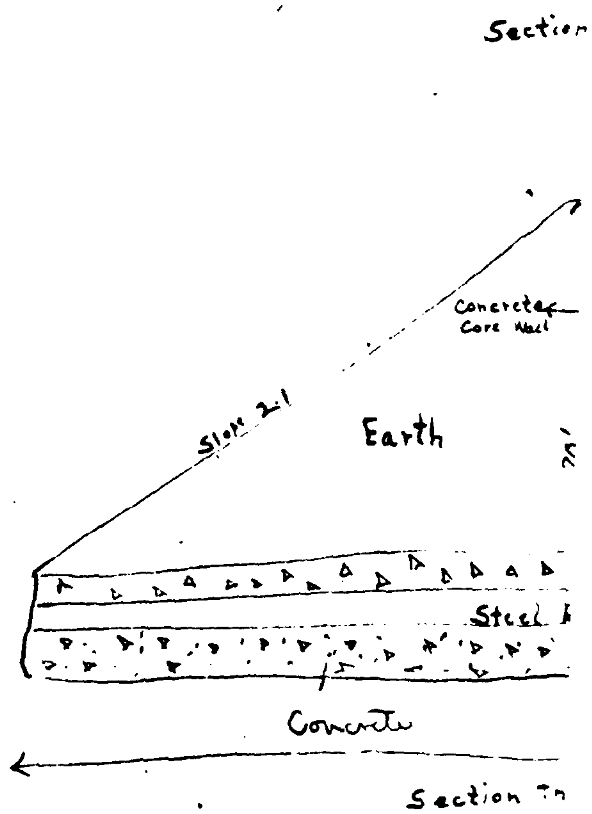
Section thru Spillway

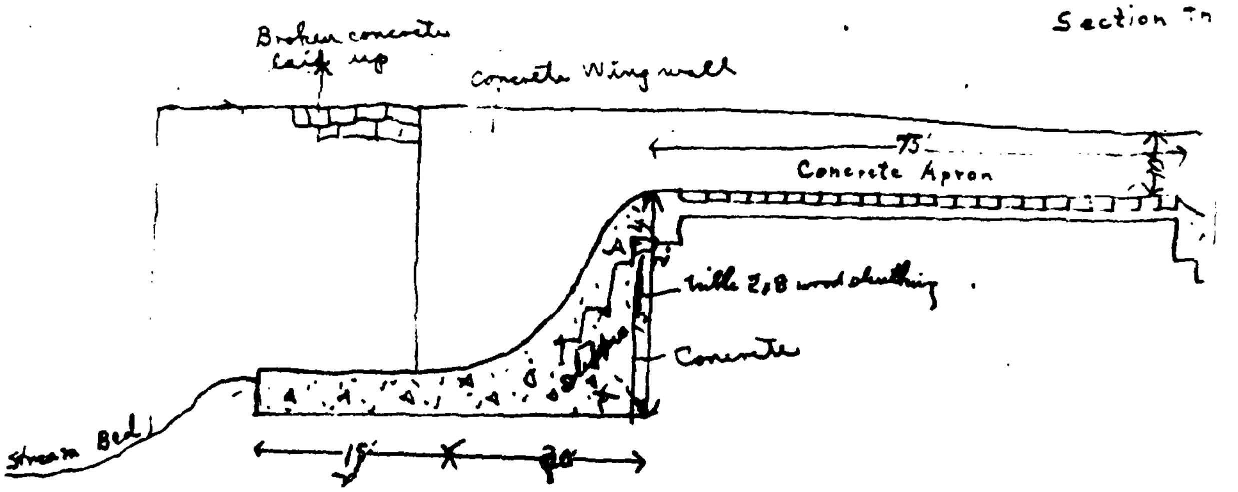


...eral plan of the dam, and its approximate position in relation to buildings or



(In the space below, make one sketch showing the form ... dam, and a second sketch showing the same information ... the greatest height of the dam above the stream bed, its t...

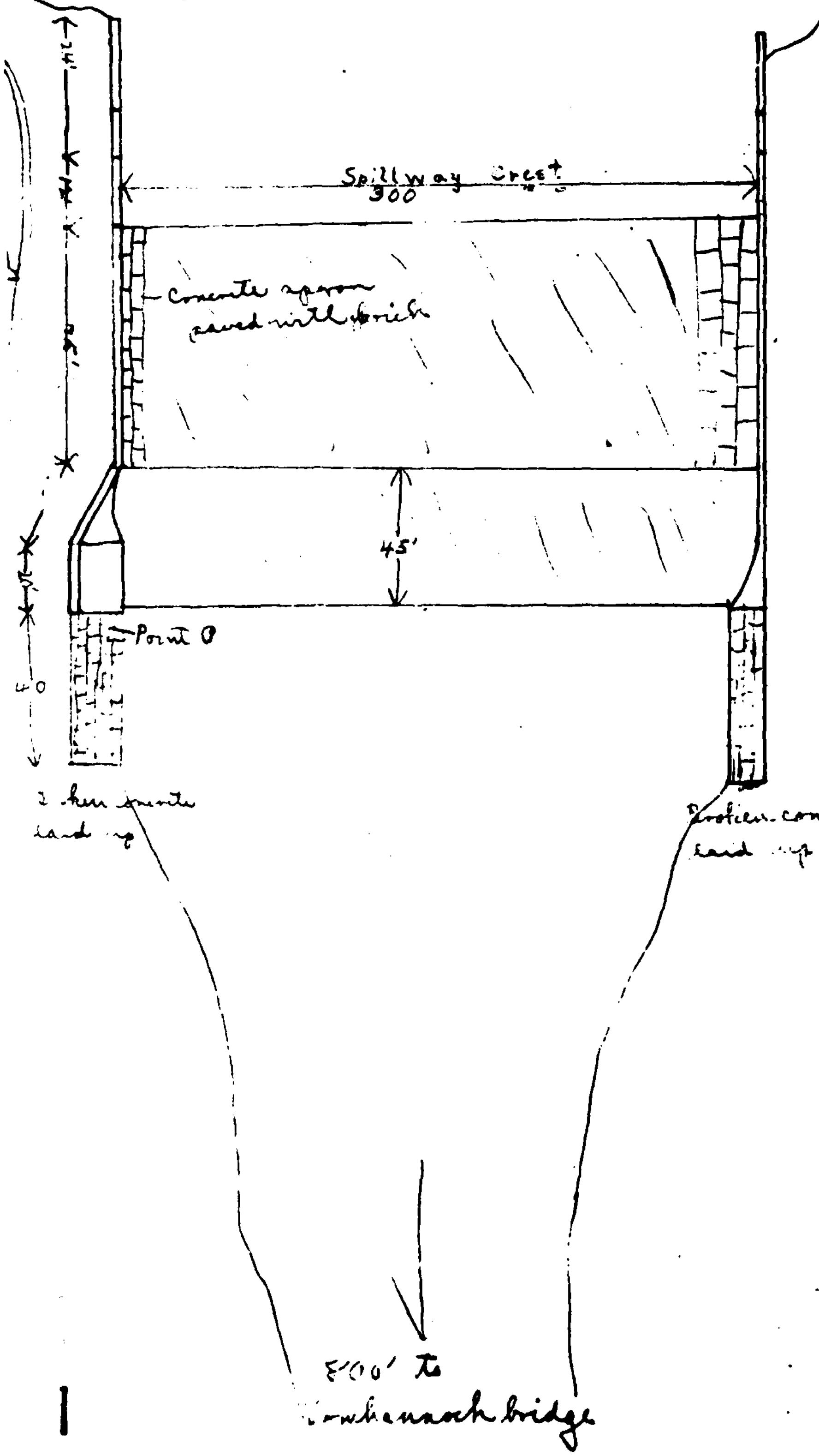


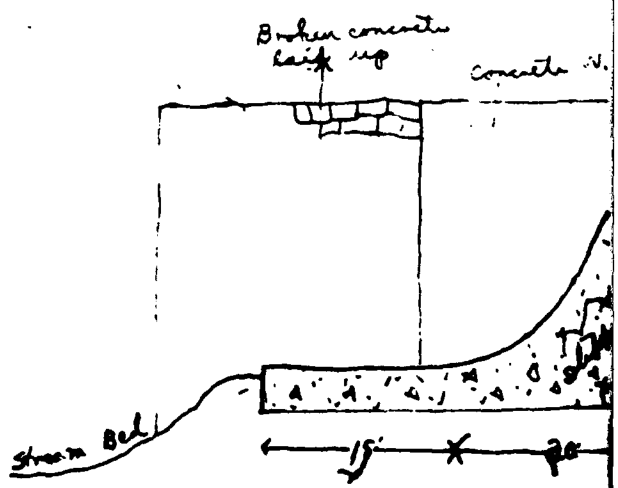


1000' to main dam

Spill Way

(In the space below, make a third sketch showing the general plan of the dam, and its approximate position in relation to buildings or other conspicuous objects in the vicinity.)





The total length of this dam is 600 feet. The spillway or waste-weir portion, is about 300 feet long, and the crest of the spillway is about 10 feet below the top of the dam.

The number, size and location of discharge pipes, waste pipes or gates which may be used for drawing off the water from behind the dam, are as follows: 5' steel riveted pipe thro dam opening by 3 sluice gates 1½' × 4 ft

At the time of this inspection the water level above the dam was ...... ft. 2 in. below ~~above~~ the crest of the spillway.

(State briefly, in the space below, whether, in your judgment, this dam is in good condition, or bad condition, describing particularly any leaks or cracks which you may have observed.)

Spillway in good condition. Slight leakage at point C.

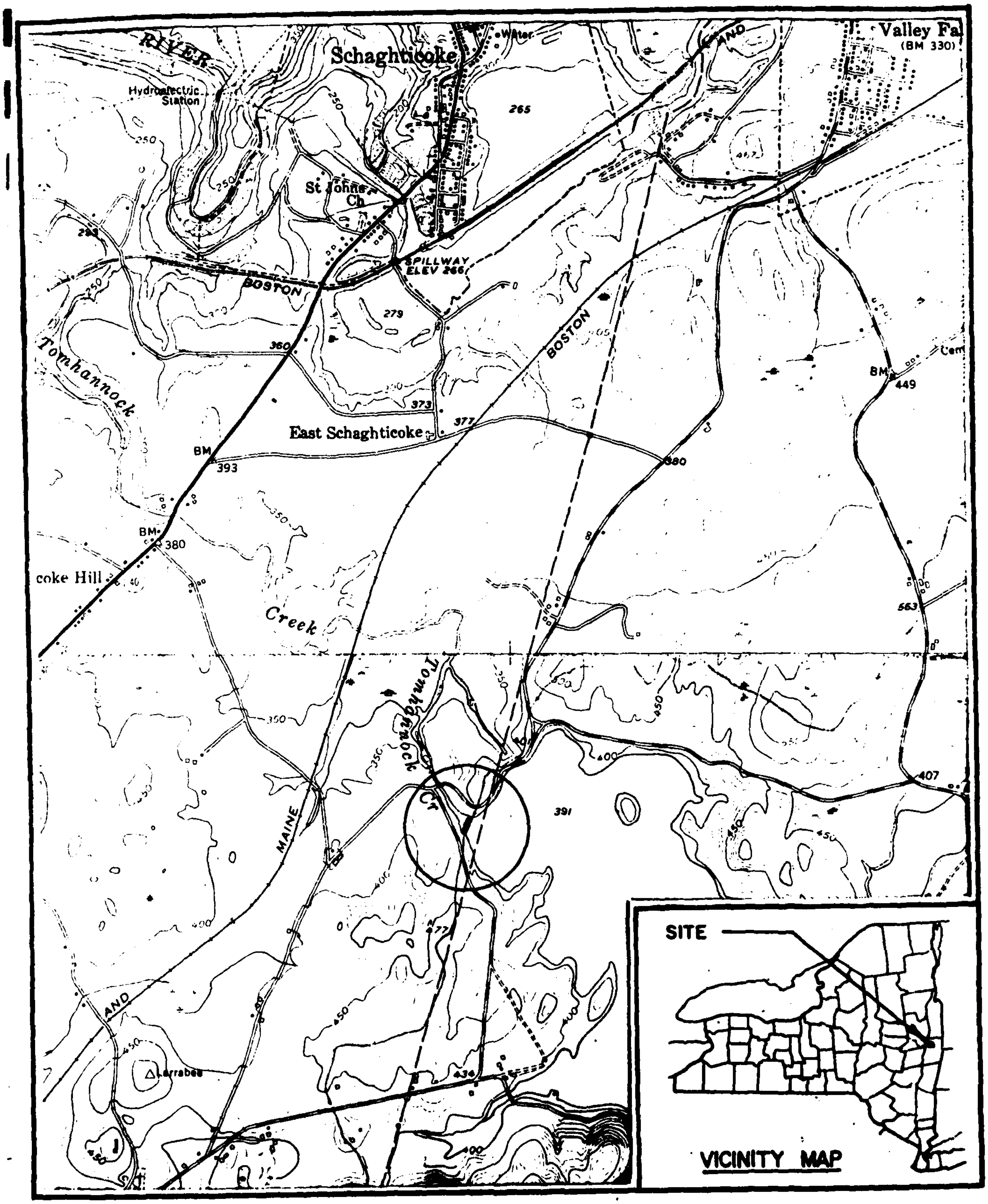
Reported by Charles A. Crudhon
(Signature)

115 Stadium Pl
(Address—Street and number, P. O. Box or R. F. D. route)

Syracuse N.Y.
(Name of place)

APPENDIX G

DRAWINGS

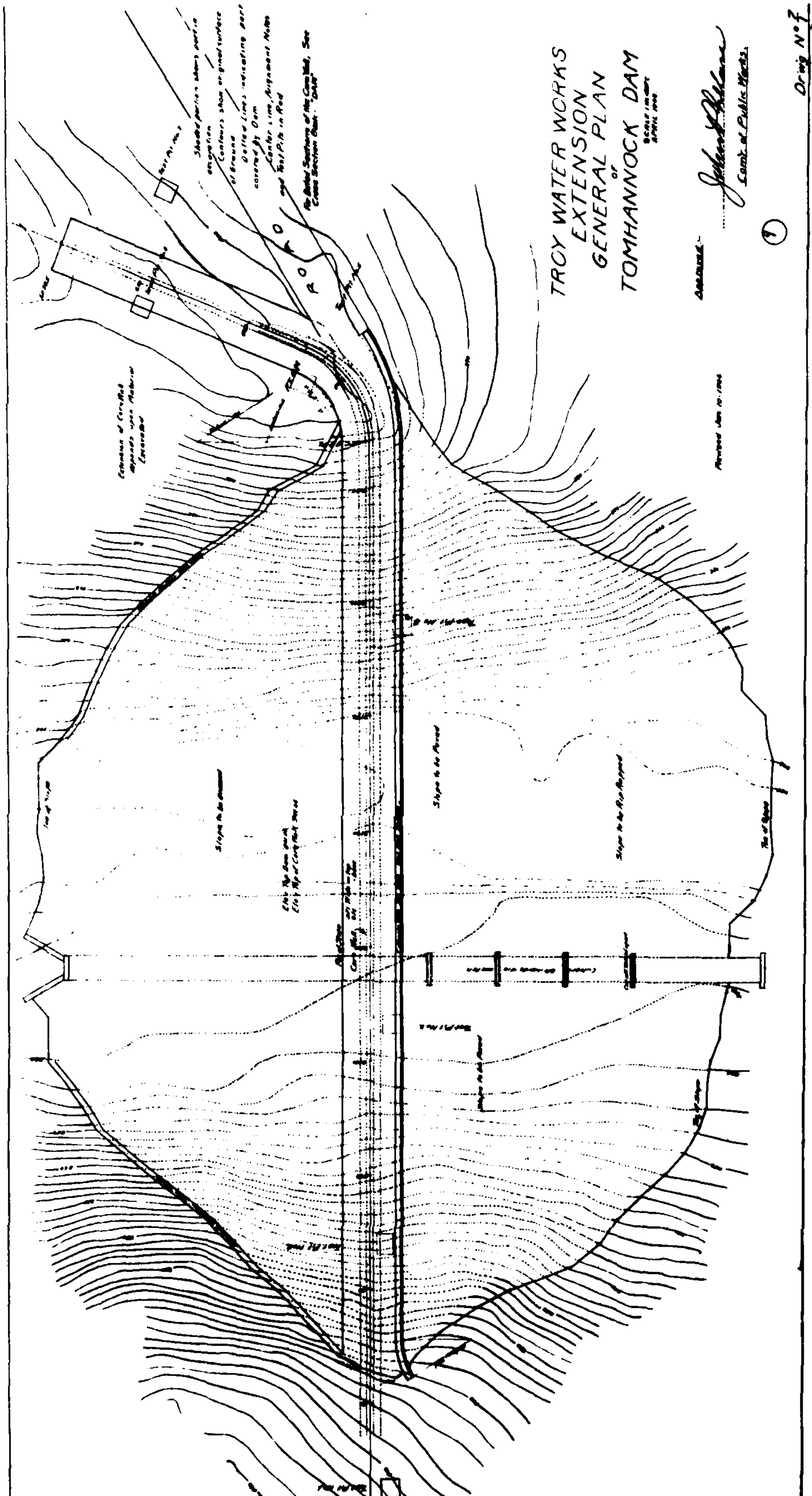


LOCATION MAP

SCALE

1000 0 1000 2000 3000 4000

FIGURE I



TROY WATER WORKS
EXTENSION
GENERAL PLAN
of
TOMHANNOCK DAM
Comr. of Public Works.
Drwg No 7

FIGURE 2

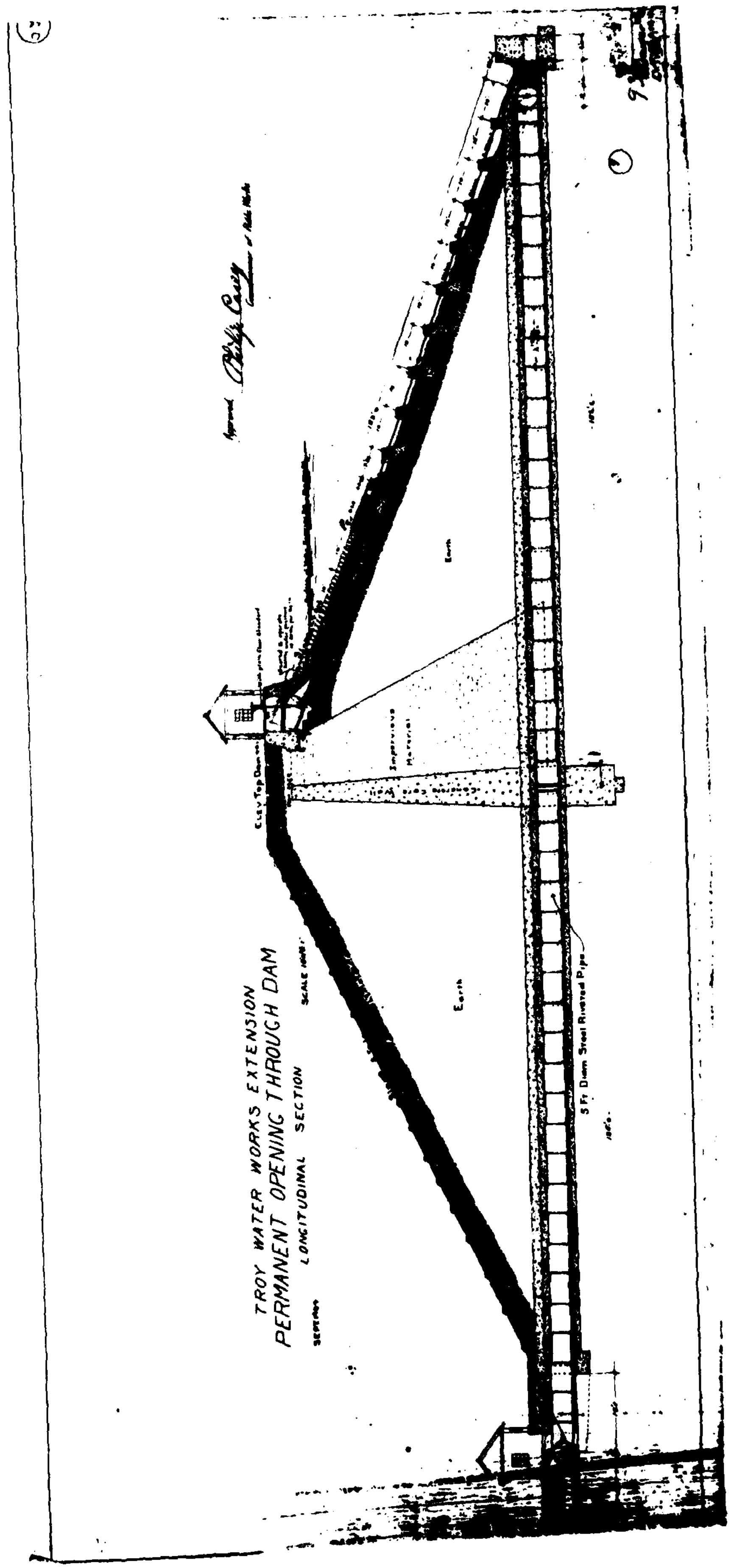
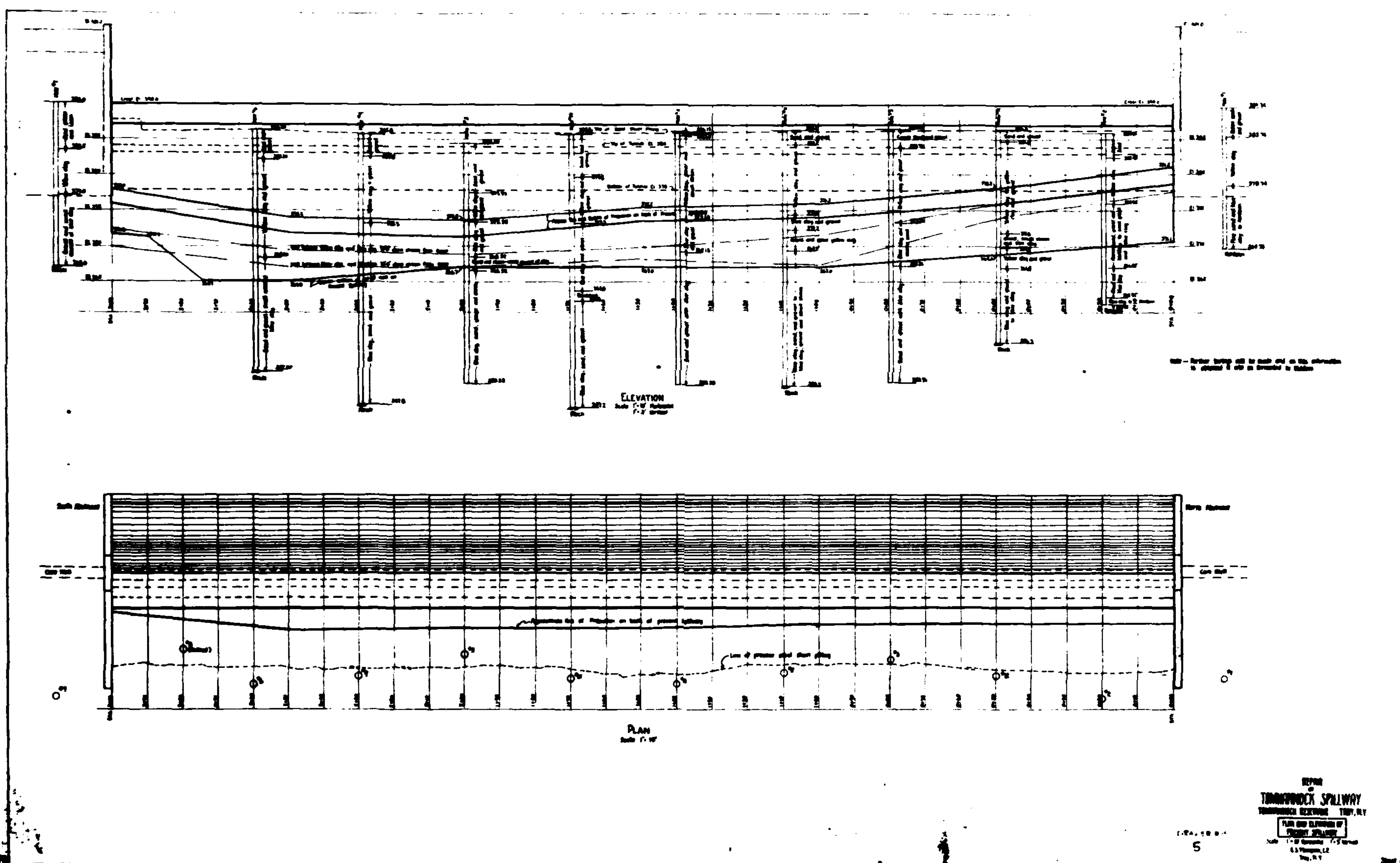

TROY WATER WORKS EXTENSION
PERMANENT OPENING THROUGH DAM
LONGITUDINAL SECTION
Earth
Earth
5 Ft Diam Steel Riveted Pipe

FIGURE 3



FIGURE

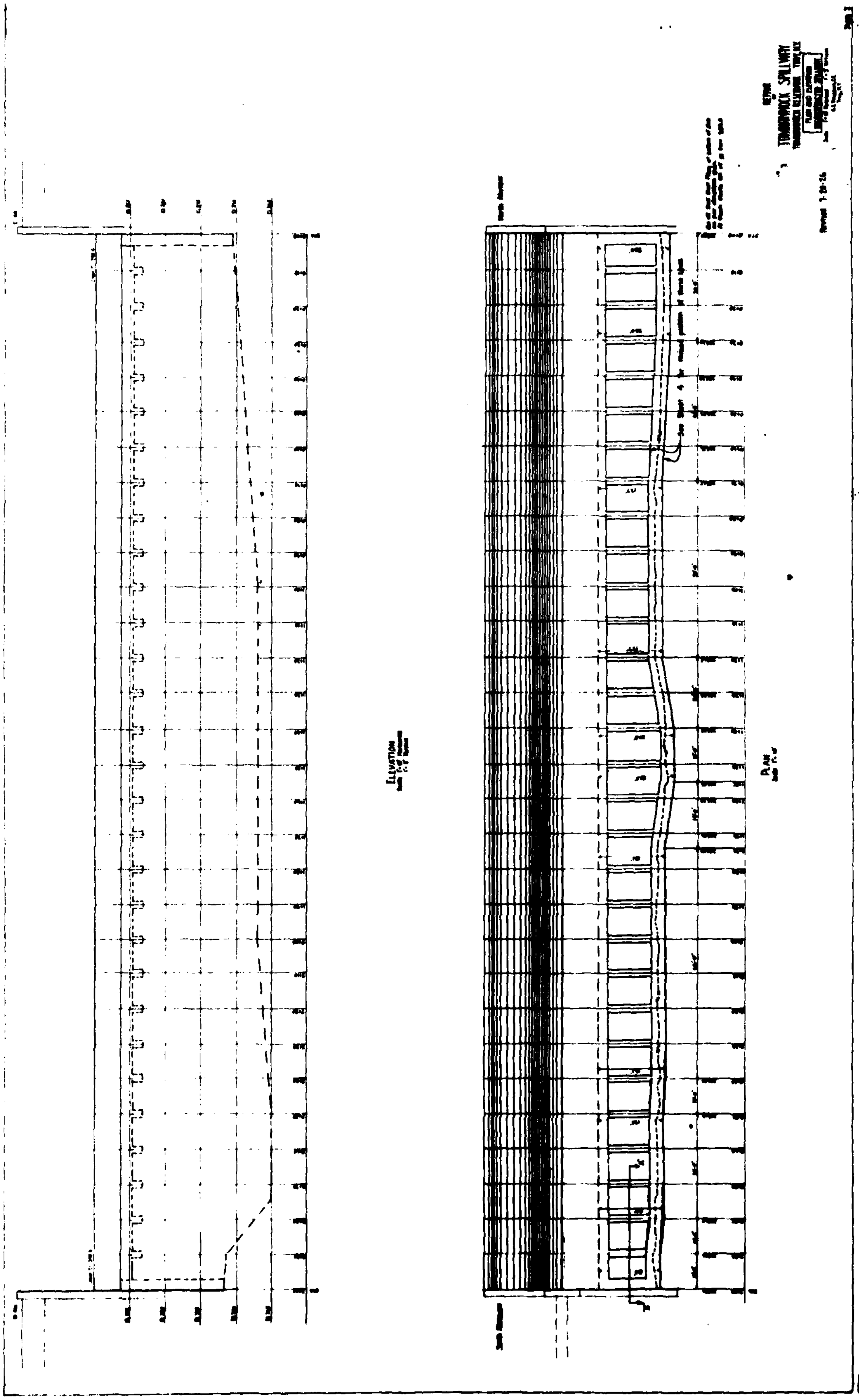
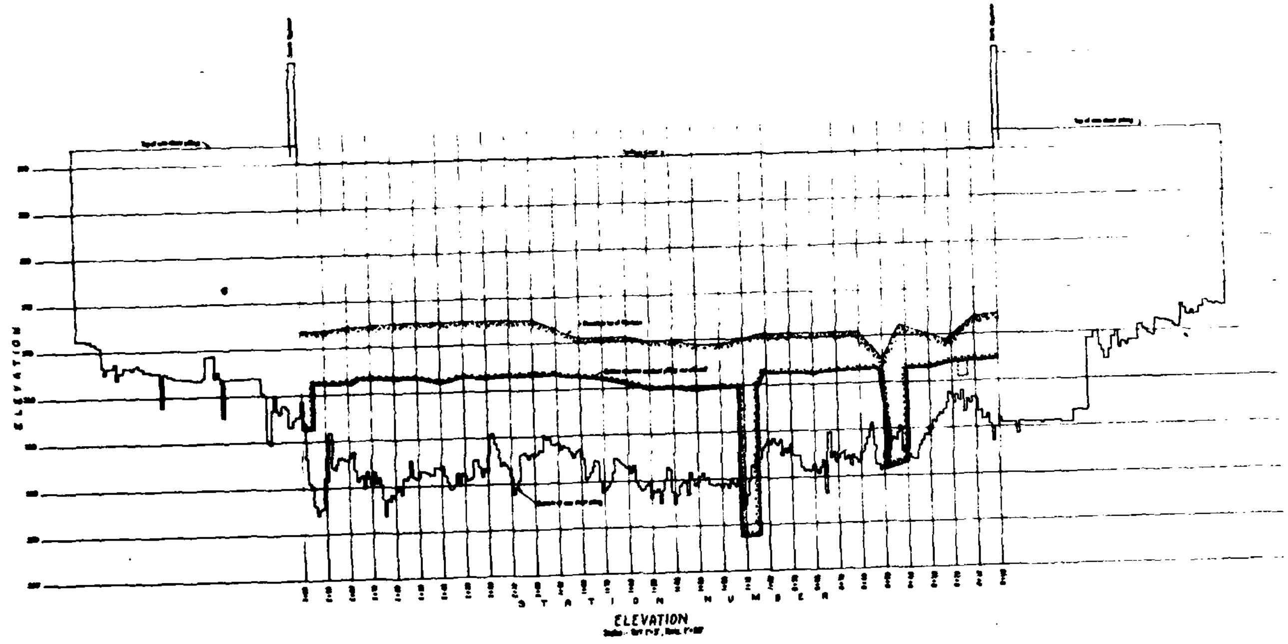


FIGURE 5

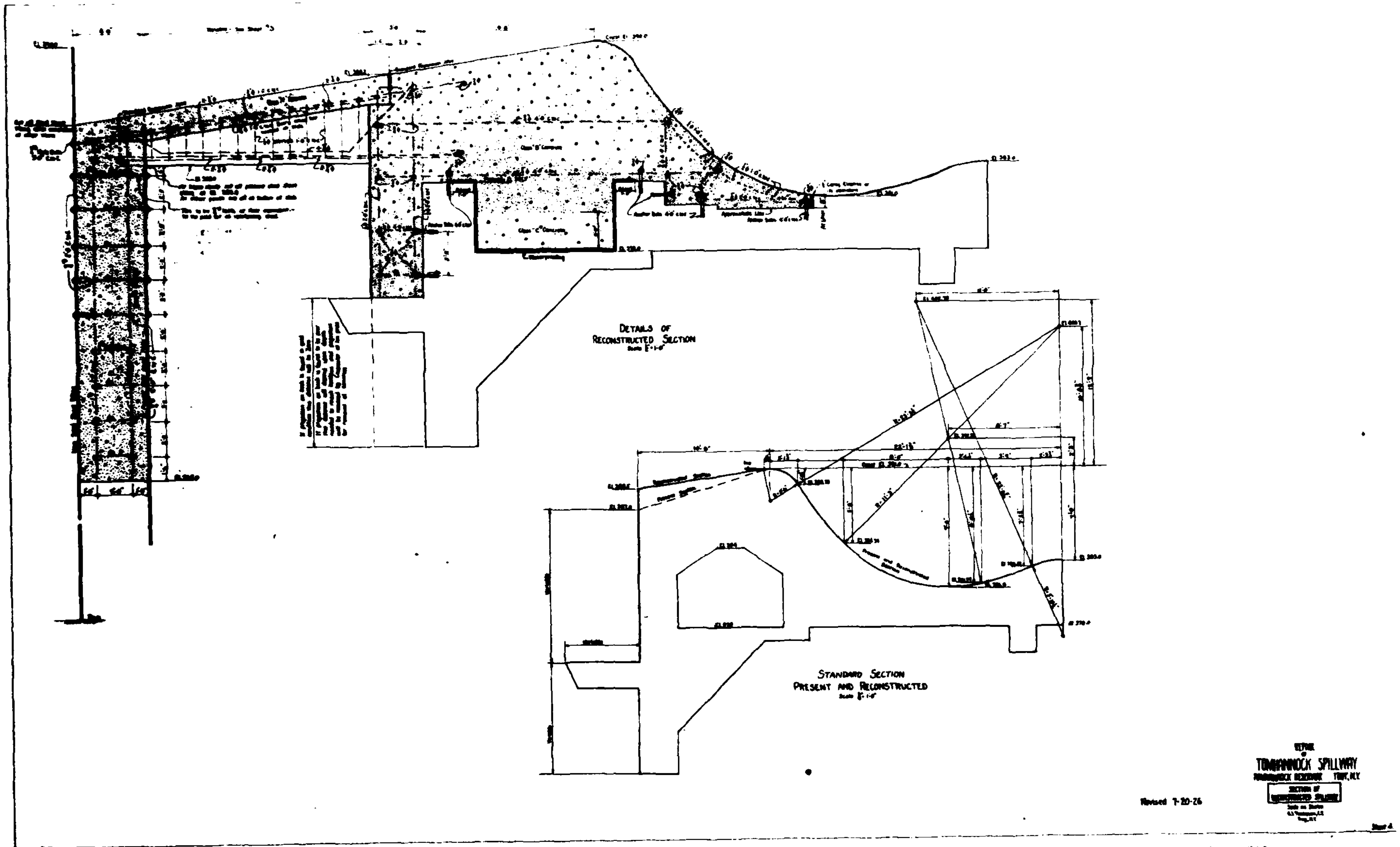


REPAIR

TOMHANNOCK SPILLWAY

TROY, N.Y.

FIGURE 6



DETAILS OF
RECONSTRUCTED SECTION
STANDARD SECTION
PRESENT AND RECONSTRUCTED
Revised 7-20-26
TOMHANNOCK SPILLWAY

FIGURE 7

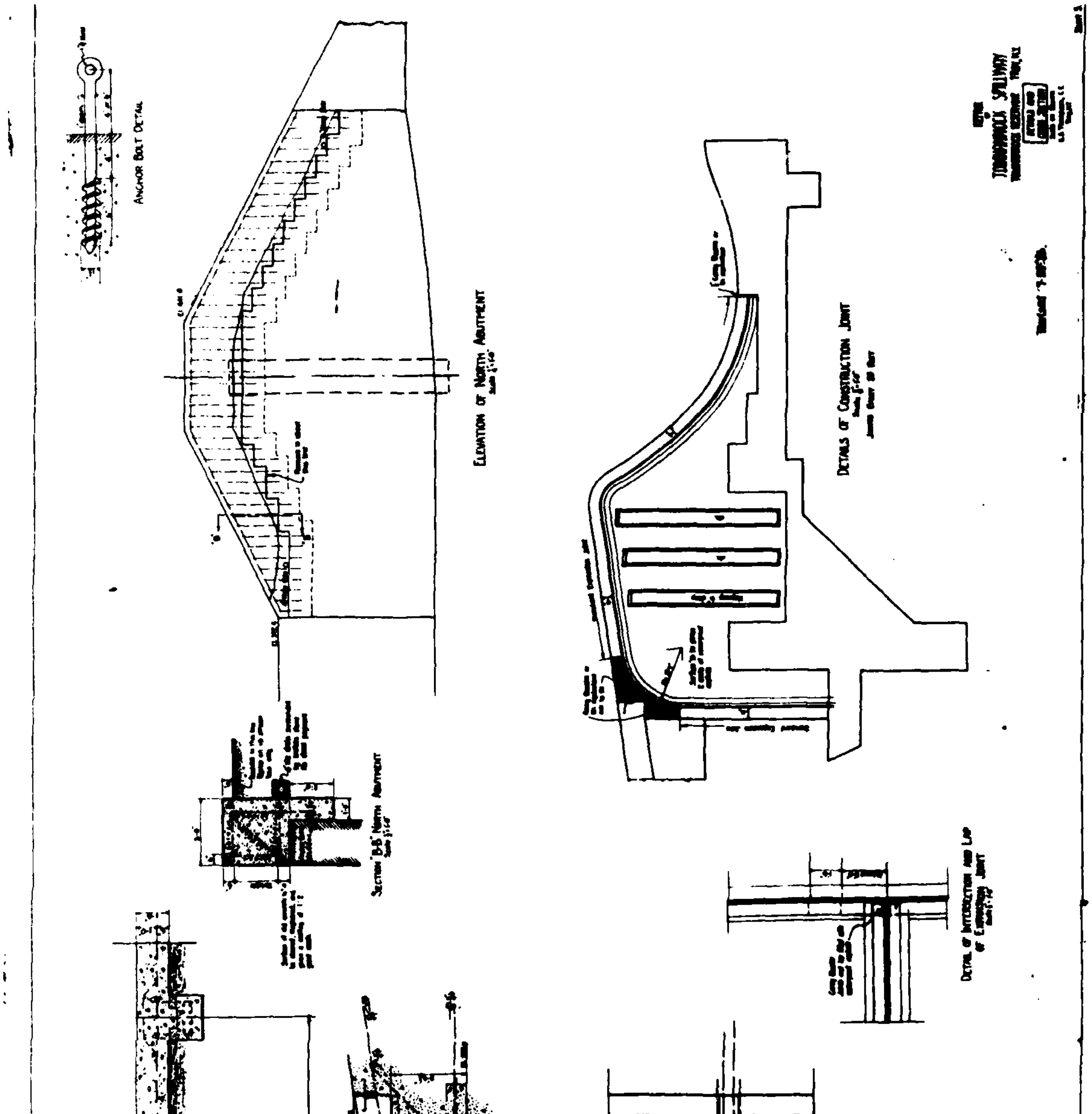
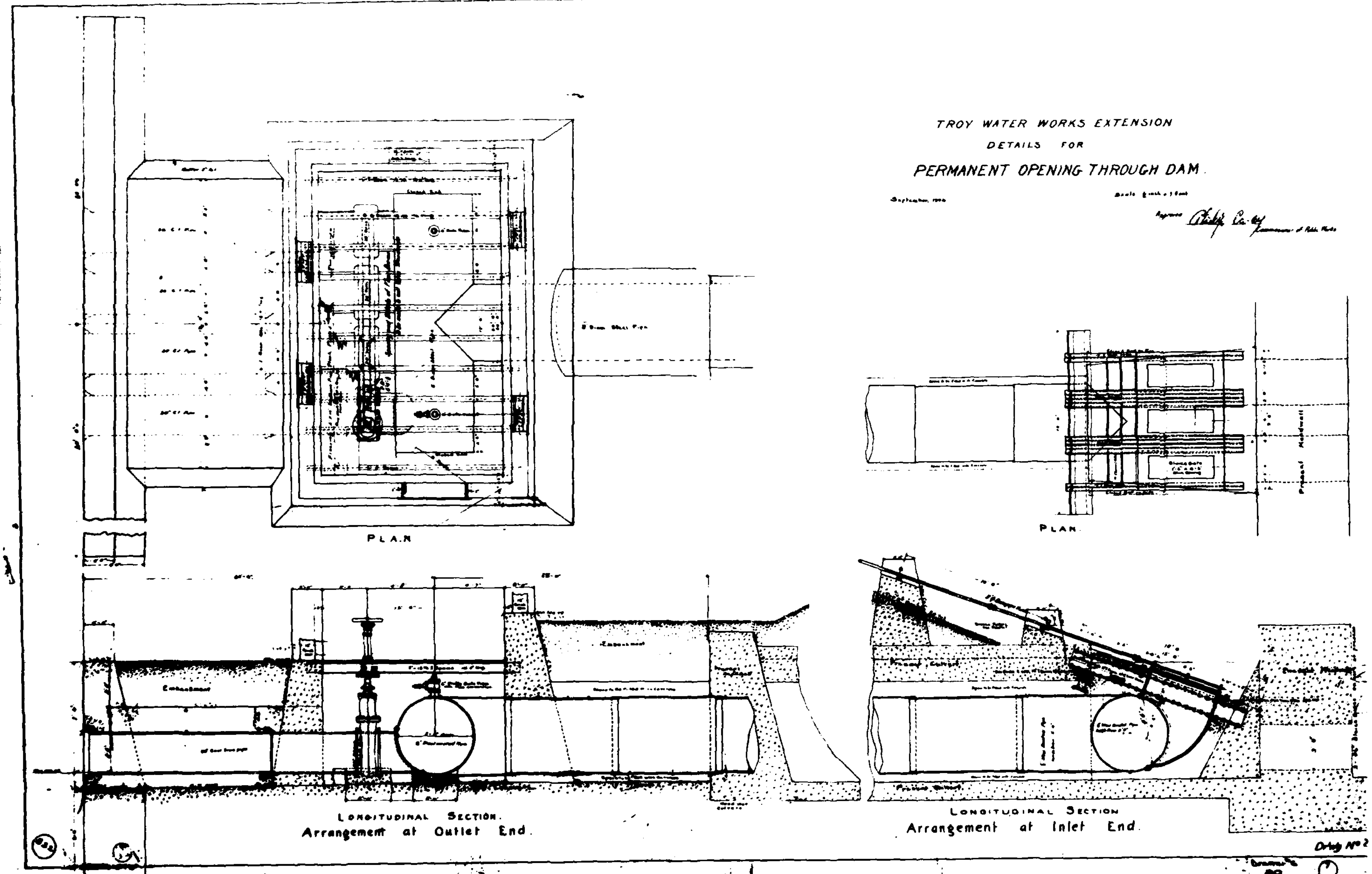
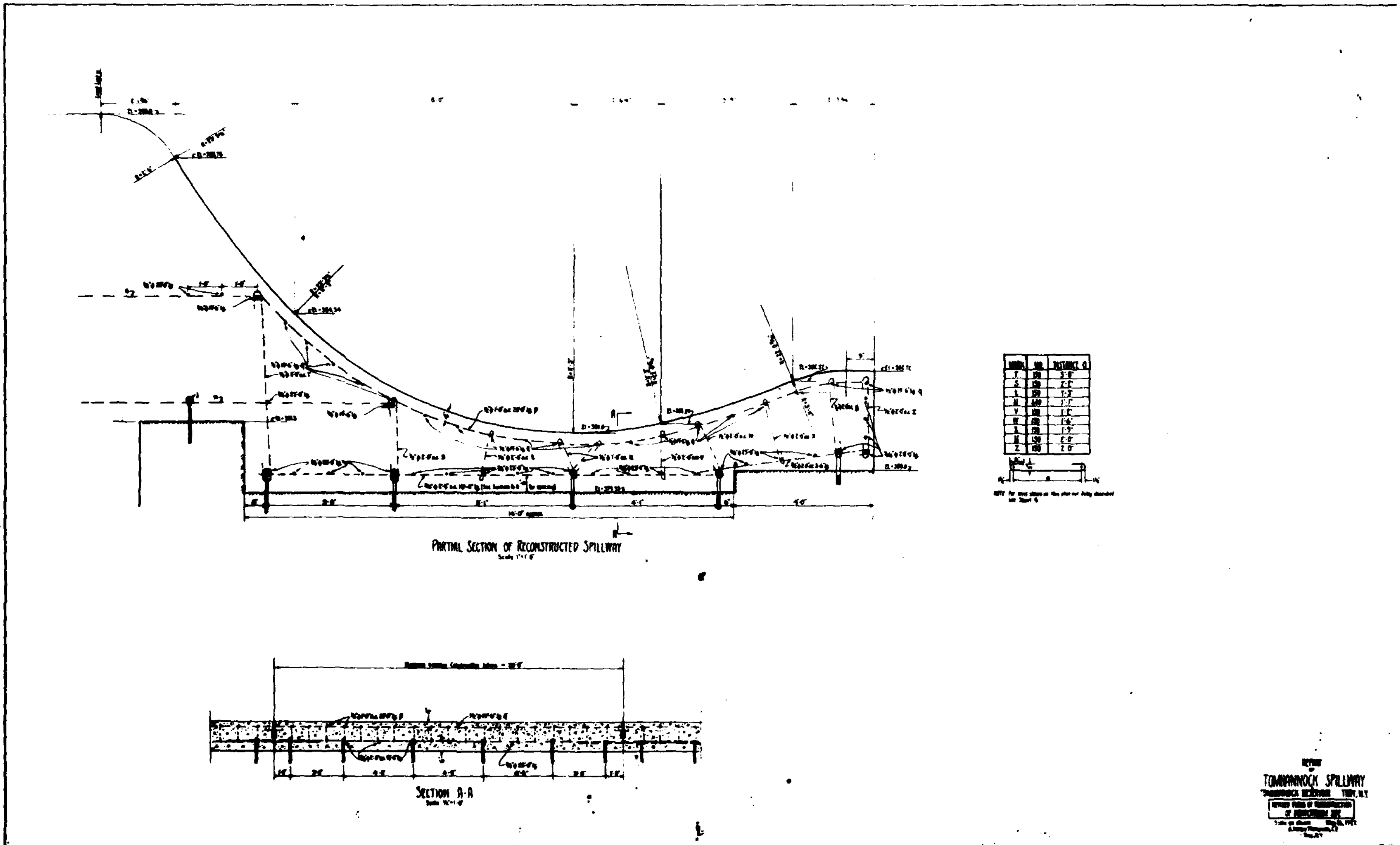

ANCHOR BOLT DETAIL
ELEVATION OF NORTH ABUTMENT
DETAILS OF CONSTRUCTION JOINT
SECTION 'B-B' NORTH ABUTMENT
DETAIL OF INTERSECTION AND LAP OF EXPANSION JOINT
SECTION 'A-A' ON SHEET 3
ELEVATION OF BEAM STRUT
PLAN OF BEAM STRUT
DETAIL OF HOOKS
DETAIL OF STANDARD EXPANSION JOINT

FIGURE 8



TROY WATER WORKS EXTENSION
DETAILS FOR
PERMANENT OPENING THROUGH DAM.
PLAN
PLAN.
LONGITUDINAL SECTION.
Arrangement at Outlet End.
LONGITUDINAL SECTION
Arrangement at Inlet End.
Drwg No 2

FIGURE 10



MARK	NO.	DISTANCE a
T	150	3'-0"
S	150	2'-3"
[illegible]	150	1'-3"
[illegible]	600	1'-3"
V	150	1'-3"
W	150	1'-6"
X	150	1'-9"
[illegible]	150	2'-0"
Z	150	2'-0"

FIGURE

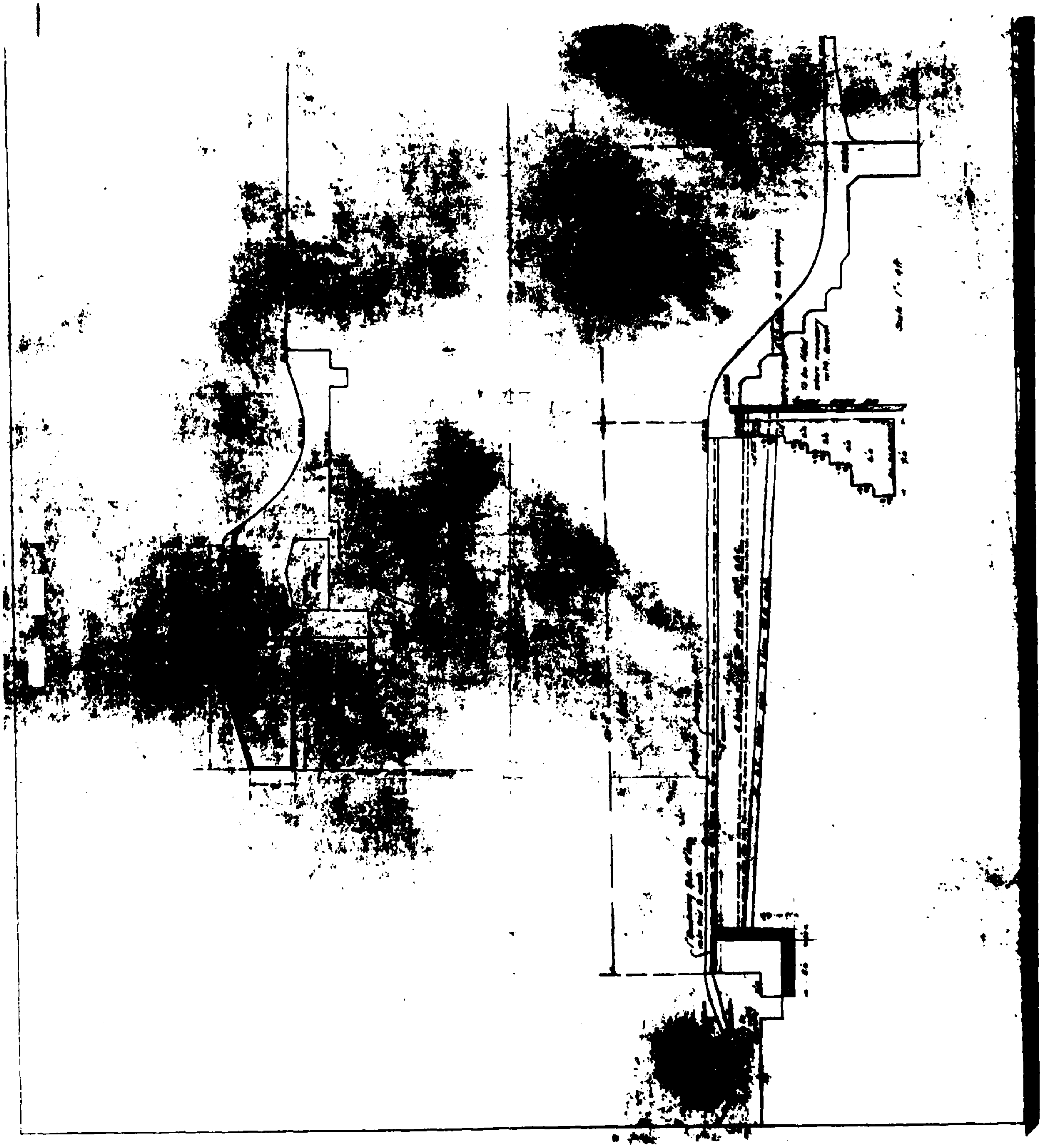
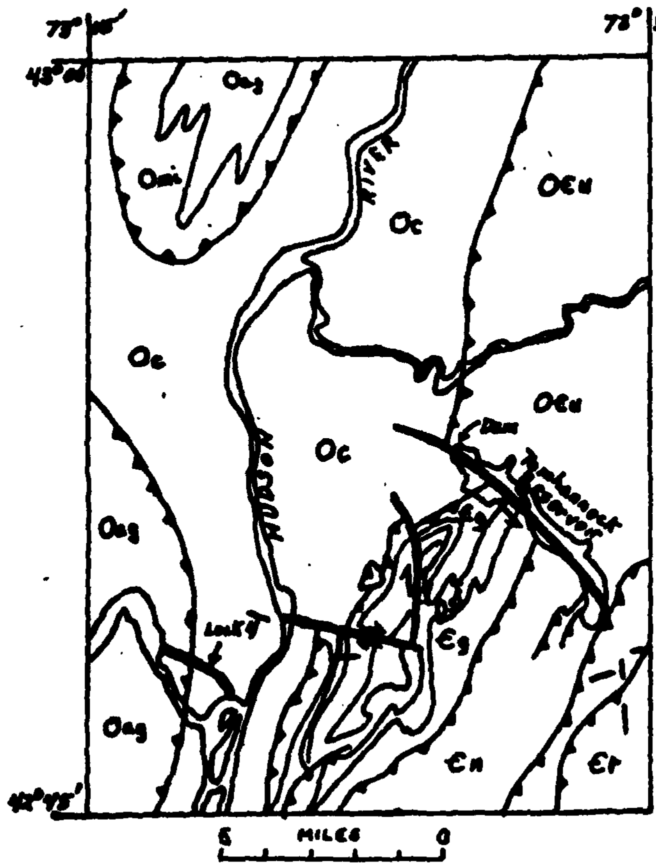


FIGURE 11



Generalized Geologic Map

LEGEND

Ordovician / Cambrian

Oc Canajoharie Shale

Oag Austin Glen Formation — graywacke, shale

Omi Mount Merino and Indian River Formations — shale, slate, chert

Osf Stuyvesant Falls Formation — shale, siltstone

OЄu Undifferentiated Middle Ordovician thru Lower Cambrian (or older?) — pelite, quartzite, limestone, conglomerate, graywacke

Єg Germantown Formation — shale, conglomerate, limestone

Єn Nassau Formation — slate, shale, conglomerate, quartzite, graywacke

Єr Rensselaer Graywacke — minor shale

Thrust fault - saw teeth on overthrust block

Fault-strike slip

Rock Unit contact

FIGURE 12

DATE
FILMED